Imperial Bureau of Plant Genetics

(For Crops other than Herbage)

Plant Breeding Abstracts

Vol. VI, No. 2.

School of Agriculture
Cambridge
England

January 1st, 1936

TABLE OF CONTENTS.

		PAGE
519	Statistics* (Empire)	101
	(Foreign)	127
575	Genetics* (Empire)	101
	(Foreign)	128
576.12	Evolution	137
576.16	Origin of species, etc. (Empire)	102
	(Foreign)	138
576.3	Cytology* (Empire)	102
	(Foreign)	138
577.8	Sex	140
578.08	Experimental Technique	104
58	Botany* (Empire)	104
	(Foreign)	140
631.421	Field Tests	144
631.521.1	Seed Selection	104
632	Plant Diseases (Empire)	104
	(Foreign)	144
633	Economic Plants (Empire)	105
	(Foreign)	146
633.1	Cereals (Empire)	105
	(Foreign)	147
633.11	Wheat (Empire)	106
	(Foreign)	148
633.13	Oats	159
633.14	Rye	160
633.15	Maize (Empire)	106
	(Foreign)	160
633.16	Barley (Empire)	107
	(Foreign)	168
633.17	Millets and Sorghums	107
633.18	Rice (Empire)	108
	(Foreign)	170
633.3	Leguminous Forage Plants	172
633.4	Roots and Tubers (Empire)	109
	(Foreign)	173
633.5	Fibres (Empire)	110
	(Foreign)	176
633.6	Sugar Plants (Empire)	114
	(Foreign)	178
633.7	Stimulants (Empire)	118
	(Foreign)	182
633.842	Capsicum (Empire)	120
	(Foreign)	189
633.85	Oil Plants	120
633.87	Tanning Plants	121
633.9	Rubber Plants (Empire)	121
	(Foreign)	189
634	Fruit Trees (Empire)	123
	(Foreign)	190
634.9	Forestry	197
635	Vegetables (Empire)	124
	(Foreign	199
	Book Reviews	204
	New Journals	210

Note.—Initialled abstracts are written by the following:

Mr. R. Ede	R. E.
Dr. H. M. Leake	H. M. L.
Dr. B. P. Pal	B. P. P.
Dr. J. Wishart	J. W.

* General studies, see also individual crops.

Plant Breeding Abstracts.

Vol. VI, No. 2.

Part I. British Empire

STATISTICS 519

311. McCLEERY, F. C. 519.24

Experimental method. Applications of the analysis of variance in experimental arrangement.

J. Aust. Inst. Agric. Sci. 1935 : **1** : 96–105.

A brief survey of the applications of Fisher's Analysis of Variance and some of its modifications.

312. BRADY, J. 519.241

A biological application of the analysis of co-variance.

Suppl. J. R. Statist. Soc. 1935 : **2** (1) : 99–106.

An experiment of the author's was designed to determine, if possible, whether any morphological plant character could be found to serve as an index of resistance to lodging in oats. The biological conclusions were given in a previous paper, (Cf. " Plant Breeding Abstracts " Vol. IV, Abst. 836) the present one being given over to a description of statistical method. The problem is how to carry through a complete analysis of co-variance with one dependent and two independent variables. The necessary stages of the analysis are completely set forth, first algebraically and second with reference to the numerical data of the experiment, and it is shewn how to make the requisite tests of significance. In this latter connexion an important modification of the tests made in the previous paper should be noted, in order to permit of Fisher's z-test being used exactly instead of only approximately. Essentially the method enabled the author to say what significance there was in treatment differences in a 9 x 9 Latin square in which the plots were adjusted to give equal values of the two independent variables, this determining the effect freed from possible sources of disturbance due to the correlation with these other factors, which are

W.

ERRATA

In " Plant Breeding Abstracts " Vol. VI, No. 1, Abst. 49, line 2, for " irrigated " read " rain-fed ". Line 4, for " rain-fed " read " irrigated ".

In Abstract No. 507

for 633.11:575.127:633.14:576.3.356.5

read 633.11:575.127:633.14:576.356.5

Plant improvement work on wheat, oats and peas. An outline of the work being done on the property of Mr. P. B. Grubb, " Strathroy," Launceston.

Tasm. J. Agric. 1935 : **6** : 105–09.

At the above mentioned centre wheat variety trials are at present in progress ; later on the stem rust resistance of some new varieties and strains imported from Australia are to be tested under severe conditions of rust on the north-west coast and may yield suitable breeding material.

Another branch of investigation is the selection of improved strains of Braemar Velvet wheat and Tasmanian Algerian oats ; single plant selections are being tested and one early strain in particular is regarded as specially promising. An attempt will also be made to eliminate susceptibility to stem rust. Similar selection work is being done with Tasmanian Algerian oats and with blue and grey peas.

Cross breeding experiments with Braemar Velvet and other imported wheats was begun in 1933, stem rust resistance and earliness being the two main aims. Twenty eight crosses were made and some have now reached the F_2 stage.

315. HUTCHINSON, J. B. 575:633:575.1
The value of pure genetics to the plant breeder.
Proc. Ass. Econ. Biol. Coimbatore (1934) 1935 : **2** : 56–57.
The author considers that the reason genetics did not formerly offer more help to plant breeders was that the bias of the earlier workers was away from the statistical aspects. Since geneticists have turned their attention to quantitative characters and to the study of dominance and heterosis the plant breeder has received more aid.
Another point in which plant breeders have received valuable help from genetics is in the utilization of species hybrids, e.g. in cotton, where single characters have been transferred from one species to another.

316. 575.1
BRIERLEY, W. B. 58
Science of the year—1934. The biological sciences.
Annu. Reg. 1934 : 49–58.
A brief but wide survey of the advances in biology in 1934. Most of the points of interest to plant breeders have been reviewed separately in " Plant Breeding Abstracts."

317. BARTLETT, M. S. and HALDANE, J. B. S. 575.14:575.123:519.2
The theory of inbreeding with forced heterozygosis.
J. Genet. 1935 : **31** : 327–40.
A particular gene or chromosome segment in a population may be kept heterozygous, either artificially as in the introduction of a foreign gene into a pure line by repeated back-crossing or naturally as in the cases of lethal genes and the like, sex determinants or genes of heterostylism, and self-sterility genes of the *Nicotiana* type.
The different cases are treated mathematically and formulae are derived to give the probability of introducing linked genes (in the first case mentioned) after n generations of back-crossing and for finding linked genes still heterozygous after n generations of inbreeding in the other cases. Corresponding expressions are given for the length of chromosome (in map units) remaining heterozygous.

ORIGIN OF SPECIES, ETC. 576.16

318. GILMOUR, J. S. L., TURRILL, W. B., 576.16
MARSDEN-JONES, E. M. and GOOD, R. 582
The species problem in phanerogams.
Proc. Linn. Soc. Lond. 1934/35 : Part IV : 103–19.
This symposium is a discussion of the difficulties arising out of the inadequacy of the system of taxonomy formulated during the eighteenth and nineteenth centuries to cope with the new concepts of the species problem that have emerged from recent ecological, genetical and cytological research.

CYTOLOGY 576.3

319. DARLINGTON, C. D. 576.356.46:575.116.12:576.312.32
The time, place and action of crossing-over.
J. Genet. 1935 : **31** : 185-212.
A preliminary brief historical survey is given and it is pointed out that the mechanisms suggested by Belling to explain crossing-over in cytological terms are unsatisfactory, while most of those suggested by Janssens can now be ignored, since the behaviour of chiasmata has been more completely elucidated. The problem, thus simplified, consists in determining the origin of the chiasma.
It has been shewn that chromatids associated at diplotene are always derived from the same chromosome, when their origin can be discovered, the evidence coming from many different

organisms and being based on behaviour in polyploids, in interchange hybrids, in plants shewing interlocking of bivalents and in other more or less abnormal forms. It follows that crossing-over occurs at all chiasmata, and hence that crossing-over determines chiasma formation. This conclusion, arrived at on purely cytological grounds, is supported by the parallelism exhibited by crossing-over (determined genetically) and chiasmata, as shewn by the similarities in their respective frequencies.

Since crossing-over must precede the appearance of chiasmata and, being between chromatids, cannot occur before the chromosomes divide at the end of pachytene, it is most probable that it occurs simultaneously with the division of the chromosomes and hence with the beginning of repulsion and chiasma formation between the chromosomes.

In *Fritillaria* species with intermittent pachytene pairing, regions are found at diplotene, between two chiasmata, where pairing has not occurred, and in such regions the chromosomes are coiled round each other (relational coiling) ; where pairing has occurred and chiasmata have been formed such coiling is not found, suggesting that chiasmata replace relational coiling. Relational coiling of chromosomes is seen at pachytene in all species, resulting from the lateral, positionally specific attraction between the genes, which prevents the chromosomes slipping round each other, and an internal change in the chromosomes, namely, an untwisting after they have paired, which also occasions their increase in length during pachytene.

These two factors, together with the longitudinal cohesion of the chromosomes, result in the latter twisting round each other until the relational coiling comes into equilibrium with the so-called molecular twisting inside the chromosomes, as can be demonstrated with wool models. Now the splitting of the chromosomes removes the lateral attraction between them and so the equilibrium is disturbed, but owing to the lag (hysteresis) characteristic of chromosome movements the torsion shewn by the relational coiling remains ; also the chromatids will now be relationally coiled round each other in each chromosome. The potential energy in this system can be released either (1) slowly, by gradual uncoiling or (2) quickly (and this is more probable) by the breakage of one of the sister chromatids of a chromosome, the newly-formed chromatids being weaker than the chromosomes were ; this will throw a disproportionate strain on the unbroken pair of chromatids, one of which will break, this break being exactly opposite the first owing to the discontinuity between adjacent genes. The chromatids will now overcome the lateral attraction of their genes and gradually slip round each other to relieve the strain during which rotation the first pair of ends to come together will be the ends of non-sister chromatids. They will join together. The result of this is that relational coiling, both of chromosomes and of chromatids has been removed in the neighbourhood of the break and the rejoin, crossing-over has taken place and a chiasma has been formed. Furthermore, the torsional strain having been relieved, the chance of occurrence of a second chiasma in the neighbourhood will be reduced ; the " interference " observed between chiasmata and between crossings-over is explained mechanically. Breakage and rejoining of two sister chromatids would reduce relational coiling between chromatids but not between chromosomes ; only crossing-over of the kind leading to chiasma formation will do both. Thus the fact that chiasmata replace relational coiling is consistent only with the view that they result from crossing-over, further proof of the neo-chiasmatype theory.

This theory of the mechanism of crossing-over, which explains it in terms of physical properties of the chromosomes which have been independently demonstrated, is applied to certain of the variations found in crossing-over and chiasma formation, such as localization, and the reduction in chiasma frequency per unit length in certain long chromosomes, and is found to explain them adequately. Chromatid interference such as is found in sex chromosomes in the heterozygous sex in *Drosophila* and *Bombyx*, however, must be attributed to special conditions.

Since the theory has been arrived at on purely cytological grounds and has an independent validity, it is permissible to use it in comparisons with conclusions derived from breeding experiments. The relative values of the cytological and genetical techniques of studying crossing-over are compared. Neither give the complete story and both are needed for an adequate analysis. The cytological technique can be used in homozygous populations, and, being applicable to every species of organism, can provide the basis for an inductive treatment of the evolutionary relationships of crossing-over.

EXPERIMENTAL TECHNIQUE 578.08

320. ROGERS, W. S. and VYVYAN, M. C. 578.087
A device for serial recording and automatic counting in categories.
J. Pomol. 1935 : **13** : 220–22.

The recording apparatus described, provisionally called a Categorimeter, consists of a portable typewriter with reset counters attached to certain keys and can be used either indoors or in the field.

BOTANY 58

321. FORSTER, H. C. and VASEY, A. J. 581.143.26.03:633.11(94)
The response of English and Australian wheats to length of day and temperature.
J. Dep. Agric. Vict. 1935 : **33** : 352-64.

Observations were made on the time of earing of an Australian and English spring wheat and an English winter wheat when sown at 7–10 day intervals throughout the year. One lot was sown under normal daylight and the other under a constant illumination of 16 hours daily.
Germination and the period from heading to maturity were influenced by temperature alone, while the rosette and jointing stages were affected both by temperature and length of day. Soil temperatures of over 15°C. prevented heading in winter but not in spring varieties, the limiting temperatures for the two spring varieties used being determined at 25° and 28°C. respectively. The method of vernalization is therefore thought to be inapplicable in practice to the Australian wheats, all of which are spring forms ; but by making use of the behaviour here described it is possible to grow two and sometimes three generations in a year.
Many apparently uniform varieties have proved markedly heterozygous in their response to the above treatments. Such heterozygosity is often manifested even as a result of a change in environmental conditions, when it is followed by natural selection of the types most adapted to the new conditions. In illustration of how natural selection acting in this way can change the constitution of a variety, reference is made to a strain of Red Marvel wheat grown for two generations in Australia which came into ear twelve to seventeen days earlier than the original strain grown from seed obtained direct from England.

SEED SELECTION 631.521.1

322. 631.521.1–1.557
POLLOCK, N. A. R. 575:633
Productive seed.
Qd. Agric. J. 1935 : **44** : 51–59.

A practical article dealing first with the relations between seed quality and factors such as size, colour, shape, weight, smell, viability and productive capacity in choosing high yielding strains of seed. Variety is also an important consideration in ensuring productivity.
In a second section a brief history and outline of the plant breeding is given and of the experimental work done in Queensland, with general notes on seed propagation plots, isolation, roguing, selection, disease resistance, types or strains, yield, bud selection, pedigree seed, etc.

PLANT DISEASES 632

323. PETURSON, B. 632.452:576.16:633.13
Physiologic specialization in *Puccinia coronata Avenae*.
Sci. Agric. 1935 : **15** : 806–10.

In 1931 a standard set of differential hosts for the identification of physiological forms of *P. coronata Avenae* was adopted by the writer in cooperation with the United States Department of Agriculture ; and the present study deals with the identification, prevalence and geographical distribution of physiological forms of the fungus, isolated from collections obtained in widely dispersed localities in Canada. An analytical key for the identification of the physiological forms is tabulated.
Eleven forms were isolated, some common and some of rare occurrence. Differences were noted in the predominance of certain forms in Eastern and Western Canada.

324. 632.484:576.16:633.11
632.484:575.242:633.11

Physiologic specialisation in *Helminthosporium* spp.
Sci. Bull. Dep. Agric. N.S.W. 1935 : No. 47 : 19–21.

On the basis of their behaviour on culture media, at 15°C. and 25°C., *Helminthosporium sativum*, *Helminthosporium M*, and *H. tetramera* could each be separated into a number of physiological forms. These forms also differed to some extent in virulence, as shewn by artificial inoculation experiments with wheat seedlings, though the number of physiological forms would have been less had this been the criterion ; on the other hand, however, different isolations of the same form sometimes differed widely in pathogenicity. Of the three species, *Helminthosporium M* was the most virulent. No correlation was found between degree of virulence and performance on agar media.

In some of the agar cultures, saltations occurred, some of which persisted in continued sub-culture, differing from the parent culture in various characters, many of them being white and sterile. More saltations occurred at 25°C. than at 15°C.

ECONOMIC PLANTS 633

325. 633–2–1.521.6:575
632:576.16:575.24

Plant pathology.
Nature Lond. 1935 : **136** : (Suppl.) 386–87.

A summary of Mr. F. T. Brooks' address at the British Association Meeting 1935. Breeding for disease resistant plant forms, and also physiological races of pathogens and their mode of origin were considered.

326. 633–1.421
Lock, G. W. 633.526.23.00.15

Programme of an agronomic investigation of sisal.
Planter 1935 : **4** (1) : 12–13 ; (2) : 6–7, 14–15.

In this outline of the the main points in evolving a reliable system of field experimentation on sisal—a crop which has not yet been investigated in this way—the necessary statistical basis of such research and Fisher's methods are indicated.

Cultivation, fibre extraction, etc. are discussed ; the proposed experimental programme, in which the role of plant selection and breeding will be a minor one is set out. Details are also given of the uniformity and variety trials, cultivation experiments and tests of bulbils versus suckers, that are contemplated. Problems relating to root systems, growth, pot cultures, cover crops, soils, etc. will also be dealt with as well as the propagation of Agave seedlings bred at Amani, the collection of Agave species and of other fibre plants.

Reference is made to the possible difficulties that may arise from inherent variation as a result of bud mutation or other causes and to the selection of planting material, seasonal variation and the evaluation of the results and harvesting.

This wide field of investigation initially chosen is open to modification and suggestions are invited from experienced planters and others interested in such investigations.

CEREALS 633.1

327. 633.1–2.42–1.521.6
Corner, E. J. H. 634.11–2.42

Observations on resistance to powdery mildews.
New Phytol. 1935 : **34** : 180–200.

Erysiphe graminis, *Sphaerotheca pannosa* and *Podosphaera lencotricha* were tested by leaf inoculation on their respective hosts which included wheat, barley, apple varieties and other plants.

The stage at which resistant hosts checked the mildew attack as well as the mode of penetration of the cells of susceptible plants were specially noted.
Norka wheat was not completely resistant.
In discussing the problem of the nature of resistance to mildew it is suggested that resistance is primarily due to toxins in the host cell but that environmental and structural factors may also operate, at least in cases of sub-infection.

WHEAT 633.11

328. AAMODT, O. S. and TORRIE, J. H. 633.11:581.48:664.641.061:578.081
Kernel texture as an indicator of quality in hard red spring wheats.
Canad. J. Res. 1935 : **13** : 79–88.

Named varieties and hybrid strains of hard red spring wheats were grown at Edmonton, Alberta on black soil and at Fallis, Alberta on grey soil in the years 1931, 1932 and 1933. Correlations were studied in the characters grain texture, protein content, loaf volume and partial baking score, from one year to another and from one locality to another, as well as the simple and partial correlation coefficients between the respective characters.
The grey soil at Fallis allows of differentiation between varieties in respect of grain texture, while the black soil at Edmonton does not bring out such differences. The most important conclusion arising from the studies is that in the wheats investigated, grain texture of samples grown at Fallis is a good index of partial baking score and loaf volume of corresponding samples grown at Edmonton, thus affording a relatively simple and inexpensive method of selecting in early generations of hybrids and discarding lines of low baking quality.
The wheat-meal fermentation time test was also tried, for comparison, but was found to be unsatisfactory owing to difficulties in determining the end point.

329. 633.11–2.451.3–1.521.6
McMILLAN, J. R. A. 633.11:575.42:578.081
The unreliability of selection in the F_2 for breeding wheat resistant to flag smut.
J. Coun. Sci. Ind. Res. Vict. 1935 : **8** : 214–22.

The material for this analysis was obtained from the F_2, F_3 and F_4 from crosses between 16 varieties of different degrees of resistance or susceptibility to flag smut (*Urocystis tritici* Koern.). Though a correlation was found between the average infection in F_2 and F_3 and a low or high percentage in F_2 was followed in F_3 by a low or high percentage respectively, on the other hand there was for all practical purposes no correlation between the healthy or diseased condition of an F_2 plant and the amount of disease in its F_3 progeny. A careful examination of the data shewed that selection for smut resistance is useless in F_2 and that an individual plant test in F_2 for the flag smut reaction is also valueless for breeding purposes. A high correlation was found between the infection in F_3 families and the corresponding F_4 progenies. Hence it is recommended that selection of resistant types should be made on the basis of the F_3 data, and from this progeny test of F_2, healthy lines can be carried on to the desired end.
Predetermination and delayed gene action are considered among the possible reasons for the extremely small (and from the practical standpoint valueless) correlation between the F_2 plant and its progeny in these experiments. (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 867.).

MAIZE 633.15

330. SANDO, C. E., MILNER, R. T. and SHERMAN, M. S. 633.15:581.19:575.11.061.6
Pigments of the Mendelian colour types in maize. Chrysanthemin from purple-husked maize.
J. Biol. Chem. 1935 : **109** : 203–11.

On the isolation and identification of chrysanthemin chloride in purple-husked maize and the biochemical basis of the genetic pigmentation factors in this series of colour types.

BARLEY 633.16

331. Bose, R. D. 633.16:581.46:575.11
Studies in Indian barleys. 3. Branched ears in barley and their mode of inheritance.
Indian J. Agric. Sci. 1935 : **5** : 155–64.

In the F_2 of a cross between Chevalier and Pusa Type 21 barleys, neither of which possesses branched ears, 21 plants out of a total population of 381 individuals shewed this character. This is very close to the expectancy on a 15 : 1 ratio, and two duplicate factors, N_1 and N_2, are postulated to produce normal development of ears, branched ears being formed in the absence of both of these factors.

One of the parents of the cross is 2-rowed and the other 6-rowed ; and in F_2, 2-rowed, intermediate and 6-rowed types were produced in the ratio of 1 : 2 : 1. No association was found, however, between any of these types and the branched character. B. P. P.

MILLETS AND SORGHUMS 633.17

332. Rangaswami Ayyangar, G. N., Hariharan, P. V. and Ramakrishnan, S. R. 633.171:575.11:581.46
Basal branching in the earheads of the Pearl millet—*Pennisetum typhoides*, Stapf and Hubbard.
Curr. Sci. 1935 : **4** : 237–38.

An unusual type of earhead is described which shewed a number of short branches at the base in contrast to the normal, unbranched type. The abnormality behaved as a simple recessive.

333. Kadam, B. S. 633.171:575.11.061.6
Colour inheritance in *Panicum miliaceum*.
Poona Agric. Coll. Mag. 1935 : **26** : 137–39.

An analysis of a cross between the Pandhari-vari and Kali-vari types of millet shewed that the anthocyanin pigmentation in the leaf sheath, leaf margin, glumes and stigma characteristics of Kali-vari was inherited *en bloc* on a monohybrid basis and as a dominant to the entirely green condition of the Pandhardi-vari type.

334. Rangaswami Ayyangar, G. N., Narayanan, T. R., Narayana Rao, T. and Seshadri Sarma, P. 633.171:575.11.061.6
Inheritance of characters in *Setaria italica* (Beauv.), the Italian millet. Part VII. Plant purple pigmentation.
Indian J. Agric. Sci. 1935 : **5** : 176–94

Plants with purple pigment may be classified into six kinds, designated P_1, P_2, P_3, P_4, P_5, P_6, according to the amount and distribution of the pigment. The interactions of four factors, P, I, V and H, are assumed to be responsible for the six kinds of purple pigmentation mentioned. Data, mostly from natural crosses, are given in support of these assumptions. B. P. P.

335. Krishnaswami, N. and Rangaswami Ayyangar, G. N. 633.171:576.312.35:576.356.5
A note on the chromosome numbers of some *Eleusine* species.
Curr. Sci. 1935 : **4** : p. 106.

Local specimens of *E. coracana*, Gaertn., *E. indica*, Gaertn., *E. brevifolia*, Br. and *E. aegyptiaca*, Desf. at Coimbatore were found to have haploid chromosome numbers of 18, 9, 18 and 17 respectively. *E. indica* is a diploid, *E. coracana* and *E. brevifolia* are tetraploids and *E. aegyptiaca* is a probable tetraploid deficient in one pair of chromosomes. The basic number is 9.

336. RANGASAMI, K. 633.171:576.354.4:581.3
On the cytology of *Pennisetum typhoideum* Rich.
J. Indian Bot. Soc. 1935 : **14** : 125–32.
At meiosis in the pollen mother cells and in megaspore mother cells, 7 bivalents were found. Three chiasmata per bivalent were seen at diplotene, but by diakinesis terminalization was complete and each bivalent had two terminal chiasmata. The only irregularities observed were occasional lagging at anaphase I and a tendency at diakinesis for the bivalents to be grouped three at one side of the nucleus and four at the other.
The development of the anther, pollen grains, ovules and embryo was also studied.

337. RANGASWAMI AYYANGAR, G. N. and PANDURANGA RAO, V. 633.174:581.46:575.11
Further data on the homology of stigmas and awns.
Curr. Sci. 1935 : **4** : 176–77.
An instance of forked awns associated with three stigmas is recorded in a family of sorghum. Also a cross between Suffra, an unawned sorghum from the Sudan with stigma and style of unequal length, and Chinna Manjal Cholam from Coimbatore which has awns in which the column and subule are equal in length as are also the stigma and the style, the F_1 was awnless and had styles and stigmas of equal length. The F_2 segregated for presence of awns, their form and relative length of style and stigma, no-awn being dominant to long-awn and the condition of equal lengths of style and stigma being dominant to the condition of unequal lengths. In the awnless group and also in the awned group there were two kinds of stigmas ; and in the latter group the relation between stigmatic and stylar lengths kept parallel to the relation between columnar and subular length of the awn. A 12 : 3 : 1 ratio was obtained for the three groups awnless, awned with equal lengths of subule and column and stigma and style, and awned with unequal lengths of subule and column and stigma and style. (Cf. " Plant Breeding Abstracts," Vol. VI, Abst. 48).

RICE 633.18

338. 633.18:575(54.8)
RAMIAH, K. 633.18–2.484–1.521.6
Rice research in Madras.
Proc. Ass. Econ. Biol. Coimbatore (1934) 1935 : **2** : p. 49.
Abstract of a paper already reviewed (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 16).

339. KADAM, B. S. 633.18:575.11.061.6:581.43
Inheritance of root colour in rice.
J. Indian Bot. Soc. 1935 : **14** : 173–78.
An extended account of an abstract already reviewed (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 550).

340. RAMIAH, K. and MUDALIAR, C. R. 633.18:575.113.4.061.6:576.356.5
The inheritance of red pericarp colour in rice (*Oryza sativa*).
Madras Agric. J. 1935 : **23** : 268–69.
From a cross between a strain with red pericarp and a strain with white, a 15 : 1 ratio of red to white was obtained in the F_2, shewing that red pericarp colour is governed by duplicate factors, which was confirmed by the segregation in F_3.
The occurrence of independent duplicate factors is an indication of polyploidy.

341. RAMANUJAM, S. and PARTHASARATHY, N. 633.18:575.242:576.354.46
An asynaptic mutant in rice (*Oryza sativa*).
Proc. Indian Acad. Sci. 1935 : **2** : 80–87.
The plant studied closely resembled the male sterile mutant previously described, (cf. " Plant Breeding Abstracts," Vol. VI, Abst. 25), but was completely sterile in pollen and ovules.
Studies of meiosis in pollen mother cells shewed that sterility was due to complete failure of pairing, with consequent irregularities in division similar to those found in other asynaptic plants.
The plant is being propagated vegetatively and crossed with normal plants reciprocally in the hope of producing polyploid or polysomic forms.

342. Ramiah, K., Parthasarathi, N. and Ramanujam, S. 633.18:576.312.36:537.531
Chromosome ring in X-rayed rice.
Proc. Ass. Econ. Biol. Coimbatore (1934) 1935 : **2** : 1–4.
Dry, wet, and germinating seeds of three varieties of rice were treated with X-rays for periods of 1, 2, or 3 hours. Among the surviving plants various mutations were observed.
One plant shewed considerable sterility and 60–70 per cent pollen grain abortion. At meiosis it shewed a ring or chain of four chromosomes, indicating reciprocal translocation. Twelve bivalents were never found in this plant, and the quadrivalent appeared to disjoin in more than 50 per cent of the cells studied in such a way that adjacent chromosomes went to the same pole, which accounts for this high percentage of pollen abortion.

343. Khadilkar, T. R. 633.18:581.46:575.247.061.6
A teratological phenomenon in rice inflorescence.
Poona Agric. Coll. Mag. 1935 : **27** : 34–36.
To explain the presence of red pigment in three abnormal spikelets occurring in a panicle of green normal spikelets, somatic mutation in the gene for glume colour is suggested.

344. Ramiah, K., Parthasarathy, N. and Ramanujam, S. 633.18:581.481:575
Polyembryony in rice (*Oryza sativa*).
Indian J. Agric. Sci. 1935 : **5** : 119–24.
Several cases of polyembryony were noted in T.24 paddy and in several hybrid progenies. Usually twins were found, but, much more rarely, triplets were also seen. The polyembryony is recognized as being of two kinds, viz. genetically identical and genetically different. In the latter category are placed the cases where a normal diploid and a haploid seedling were produced from the same seed, and a normal and an albino seedling from the same seed.
The origin and significance of polyembryony are briefly discussed. B. P. P.

ROOTS AND TUBERS 633.4

345. Moldenhawer, K. 633.41–1.524.4:581.192(43.8)
Studies on wild beet. *Beta Maritima*, of the North Sea Region.
Brit. Sug. Beet Rev. 1935 : **9** : 47–49.
An initial study of wild beet plants as a preliminary to breeding work. The morphological characteristics and habit are described. A chemical analysis revealed a sugar content ranging from 7·8 per cent to 13·8 per cent with an average of 10·4 per cent, which is compared with recent results obtained by other workers.
Hybridization of cultivated varieties with the wild, hardy perennial, frost-resistant type with a relatively high sugar content is now being carried out in Poland. (Cf. " Plant Breeding Abstracts," Vol. III, Abst. 664, and Vol. IV, Abst. 452).

346. 633.42:581.162.3:581.162.5
Ali Mohammad 633.42:575.14
Pollination studies in toria (*Brassica napus* L. var. *dichotoma*, Prain) and sarson (*Brassica campestris* L. var. *sarson*, Prain).
Indian J. Agric. Sci. 1935 : **5** : 125-54.
The floral mechanism in toria and sarson does not favour self-pollination and cross-pollination is the rule, with the exception of a yellow-seeded sarson form in which considerable self-pollination takes place. The insects mainly concerned in the cross-pollination are *Andrena ilerda*, *Apis florea* and *Halictus* sp.
Pod-setting and seed formation in artificially selfed flowers was appreciably better than in bagged flowers but much inferior to that in unbagged flowers exposed to insects. The poor results obtained under bags are probably to be attributed to the exclusion of insects as artificial crossing under bags resulted in excellent setting.

Flower buds selfed 2–3 days before opening in the case of toria and 3 days before opening in the case of sarson gave good pod-setting and good seed formation which compared favourably with that obtained when the flowers were left uncovered. If self-sterility be due to the secretion of a substance which inhibits the growth of pollen tubes of the plant's own pollen, then the substance must be secreted only 1–2 days before the flower opens.
The stigma remains fully, or nearly fully, receptive for about three days, after which there is a decline; after five days hardly any pod-setting or seed formation is obtained. The pollen remains viable for a period of seven days or more after collection from freshly opened flowers.
As inbreeding results in decrease of vigour and yield, mass selection is recommended as a means of improving the crop. In the case of the yellow-seeded self-fertile form of sarson, however, several unit species, some of which are very promising, have been isolated from the ordinary mixed variety by inbreeding.
Crosses between toria and sarson were obtained readily. The results are not given in detail but it is stated that there are indications that self-fertility is inherited independently of colour of seed. B. P. P.

FIBRES 633.5

347 633.51 U.4

PARNELL, F. R. 633.51:575(68)

The origin and development of U.4 cotton.

Emp. Cott. Gr. Rev. 1935 : **12** : 177–82.

A detailed account of the selection and breeding work from 1924 onwards which has led to the production of U.4 cotton. Certain points of interest in the methods of selection and the performance of various strains, both existing and in process of development, are mentioned.
U.4 is very adaptable and has been successfully grown in countries far from its place of origin. Recently U.4 has been crossed (in Trinidad) with a number of other varieties, and the material from U.4 crossed by Cambodia and back-crossed by U.4 has shewn promise at Barberton. Whether it will be possible to combine the very hairy Cambodia leaf (a defence against jassid attack) with the good qualities of U.4 still remains to be seen.

348. 633.51:575(54)

The Indian Central Cotton Committee: its objects, activities and achievements.

Published by R. D. Mihra, Bombay 1935 : Pp. 27.

A further edition of the pamphlet already reviewed in "Plant Breeding Abstracts," Vol. IV, Abst. 860.

349. SAWHNEY, K. 633.51:575.54.9

Cotton improvement work in Hyderabad State.

Proc. Ass. Econ. Biol. Coimbatore (1934) 1935 : **2** : 41–44.

Though a highly valued variety on account of its spinning properties, *Hyderabad Gaorani* has three great drawbacks, low yield, high proportion of seed to lint and bolls which to not open fully. As a result, short staple varieties had been tending to replace it, and breeding work was undertaken to rehabilitate the *Gaorani* variety.
About six superior strains selected from this variety are now under test. Other methods employed were the introduction of varieties from other parts of India, without much success, and selection among the progeny of a cross between *Gossypium neglectum* var. *rosea* and Bani 306 (*G. indicum*, one of the imported strains). From the cross a type with the plant habit and ginning out-turn of *roseum* but with a staple length of nearly one inch has been produced.
Work is also in progress on American varieties.,

350. BALLS, W. L. 633.51:575(62)

Giza.

Emp. Cott. Gr. Rev. 1935 : **12** : 286–96.

An historical account of the organization, vicissitudes, and activities of the Cotton Research Board at Giza is included in this paper, with information on selection and breeding of cotton and the methods employed at the various stages of the work.

351. Nye, G. W. 633.51:575(67.61)
Notes on cotton breeding in Uganda.
E. Afr. Agric. J. 1935 : **1** : 44–49.

Cotton in Uganda is mainly grown to meet the demand for a long stapled type and breeding work therefore aims at producing varieties with long lint. In the eastern area the soil and climate are unfavourable to the production of long lint and varieties are grown which are low in yield. In general the problems to be solved are the combination of long lint with high yield, low boll shedding, high ginning out-turn and disease resistance. The diseases encountered are blackarm and *Fusarium* wilt, while Jassid and Pink Bollworm are pests which also have to be considered.

Varieties which represented improvements in some or all of these characters have been released in the past, the methods of improvement used being chiefly new introductions and selection, for which there is a wide field in the heterogeneous crops grown in Buganda. Cross-breeding is also employed but only to a limited extent.

The technique of selection and variety testing is described ; varieties are finally tested for a number of years in several localities before being distributed.

352. 633.51:575.11(96.1)
Anson, R. R. 633.51.0014(96.1)
Summary of work on cotton-growing in the Fiji Islands, 1926–1935.
Emp. Cott. Gr. Rev. 1935 : **12** : 300–06.

The activities of the Cotton Experiment Station opened at Sigatoka in 1926 were directed mainly towards finding a substitute for Sea Island cotton for which the demand was declining. Seven varieties of various species and all imported, except one found growing locally, were tested during two seasons. It was found that only pure Kidney cotton, a New Guinea hybrid (from selections made from Kidney hybrids in New Guinea) and Sea Island could be regarded as of economic value for cultivation in the Fiji Islands. As a result of further investigations based on spinning tests it was decided to cross the Kidney type with Sea Island and to back-cross the New Guinea hybrid (which had probably originated from a natural cross between Sea Island and Kidney cottons), the ultimate aim being a cotton fairly resistant to blackarm and having a moderately fine long cotton that could compete commercially with Egyptians. During several seasons selection for length and fineness was carried out and in 1933–34 the lint from a set of six second back-crosses gave a yarn stronger than the control but still too long in staple for blending with Egyptians. Both these defects can be remedied to some extent, and it is suggested that, since an adequate estimate of the value of this cotton cannot be obtained from small samples, this cotton should be multiplied up to commercial proportions and offered for sale in the English market.

353. Brown, C. H. 633.51:575.116.1
The correlation of certain characters in Egyptian cotton.
Emp. Cott. Gr. Rev. 1935 : **12** : 216–20.

Examination of a large number of targets of pairs of characters shewed no correlation between ginning out-turn and halo length or between boll-content weight and hair weight per cm., a positive correlation between seed weight and boll-content weight and between seed weight and hair weight per cm., and a negative correlation between ginning out-turn and seed weight.

The close correlation between seed weight and hair weight per cm., found in the present strain (Giza 19) and probably occurring in all the other strains too, indicates that purification for seed size automatically gives the greatest possible purity for fineness.

Segregation in seed size was found in most of the Egyptian strains examined. Segregation for hair weight too is illustrated and shewn to be correlated with the seed weight fluctuations.

354. Rounce, N. V. 633.51:575.42
Cotton selection and rotation of supply of improved cotton seed.
E. Afr. Agric. J. 1935 : **1** : 35–36.

The value of selection in general and in cotton in particular is mentioned. In the case of cotton, the difficulty of producing and maintaining a pure line renders it necessary to have a continual supply of fresh seed, and the method of producing and distributing improved seed is outlined.

355. Skovsted, A. 633.51:576.312.35:576.356.5
Chromosome numbers in the Malvaceae. I.
J. Genet. 1935 : **31** : 263–96.
The chromosome numbers of about 120 species, drawn from 25 genera are reported and illustrated. Polyploid series with basic numbers of 5, 6, 7, 11 and 13 were found, and other numbers which did not fit into any of these series.
In the main there was a strong correlation between cytological investigations and taxonomy. In most genera all species examined belonged to the same series while in those genera where this was not the case, the groups distinguished cytologically were also distinguished morphologically.

356. Abraham, P. 633.51:581.47:575.11
Preliminary studies in the anatomy of the gynoecium of cotton with reference to boll dehiscence.
Proc. Ass. Econ. Biol. Coimbatore (1934) 1935 : **2** : 22–32.
The degree of opening of the boll is a character of great economic importance in cotton and certain forms such as Karunganni (*G. indicum*, Gammie) and other members of the Nanking group have faulty or incomplete dehiscence of the boll.
Anatomical investigations shewed that the degree of opening was dependent on the extent to which the marginal (ventral) bundles of the carpels were fused in the placenta ; in bolls which open fully the bundles are fused only for a short distance at the base of the placenta, but in *G. indicum* fusion extends much higher up the placenta.
In crosses between *G. indicum* and *G. N. roseum* or *G. sanguineum*, forms with fully opening bolls, the F_1 plants all had fully opening bolls, with placental bundles fused only for a short distance, while in the F_2 segregation was observed in the ratio 3 fully opening : 1 incompletely opening. Studies are in progress on the F_2 population to determine whether the anatomical structure is inherited in the same way as boll opening, as is to be expected.
Since the character " boll opening " appears to be inherited in a simple Mendelian fashion, there should be no obstacle to breeding it into Indian cultivated races of cotton.

357. 633.51:581.48:575.11
Hutchinson, J. B. 633.51:677.21:575.11
The genetics of cotton. Part XV. The inheritance of fuzz and lintlessness and associated characters in Asiatic cottons.
J. Genet. 1935 : **31** : 451–70.
Three crosses between tufted varieties (in which the fuzz is reduced to a tuft at each end of the seed) and fuzzy varieties shewed that the tufted condition is determined by a single main gene (*T*) operating without dominance, the heterozygotes being high-grade tufted, i.e. with a large amount of fuzz. In two cases the fuzzy varieties were shewn to carry modifying factors causing a reduction in the amount of fuzz. The semi-tufted condition, in which fuzz is absent from a patch on the dorsal surface of the seed, was found to result from the action of the same main gene, whose intensity of expression is greatly modified by other minor genes, those intensifying the tufted condition being apparently dominant.
In two crosses between semi-tufted and fuzzy types of the Chinese variety " Million Dollar " a proportion of fuzzy seeded plants appeared in the F_1, shewing that the minor factors are collectively capable of reducing the effect of the major gene almost to vanishing point.
It was found that there was a factor increasing the thickness of fuzz in fuzzy plants and the amount of fuzz in tufted plants associated with the factors *L* for leaf shape and *K* for lint colour.
The main factor pair *T* (tufted) —*t* (fuzzy) was found to be inherited independently of the leaf shape series (L^L–*L*), the anthocyanin series (R^s–r^g), corolla colour (*Y*–*y*), lint colour (3 factors *K*–*k*, D_1–d_1 and D_2–d_2), and leaf nectaries (*N*–*n*).
The recessive factor H^g, causing lintlessness and complete absence of hair throughout the plant body was found to be distinct from *T* and not linked to it. On testing the linkage of h^g with the factors for anthocyanin colour, excesses of non-cross-over types occurred, but were of

doubtful significance ; similar behaviour was noticed in the lintless-leaf shape and lintless-corolla colour ratios, while leaf nectaries segregated quite independently. Certain anomalies were noticed in the segregation of anthocyanin pigment and of leaf shape in the same crosses, and the reason is to be investigated.

Significant correlations between pedicel or bracteole hairiness in the F_2s of certain crosses segregating for the main gene *T* and for fuzz modifying factors shewed that the latter also affected hairiness of the plant body to some extent.

Studies on lint length in relation to the tufted condition shewed that the Chinese strains carried a gene for long lint linked with *T*. Evidence was also obtained of an allelomorphic series for seed weight in the same chromosome as *T* and the increase in seed weight caused by such factors were accompanied by increases in lint index (weight of lint in grm. on 100 seeds), the lint percentage (weight of lint in grm. on 100 grm. of seed) remaining unaltered.

The results are discussed in connexion with the artificial selection which has occurred. It is pointed out that no support was obtained for the belief that absence of fuzz is associated with reduction in ginning percentage.

358. Hutchinson, J. B. and Panse, V. G. 633.51–1.421

Studies in the technique of field experiments. I. Size, shape and arrangement of plots in cotton trials.

Indian J. Agric. Sci. 1935 : **5** : 523–38.

As a preliminary to an extensive experimental programme for fundamental research on cotton the authors are engaged in a number of investigations on statistical technique. The sowing of one hundred and thirty-eight rows of cotton in a uniformity trial provided material for the study of variation by the calculation of standard errors for various sizes and shapes of plot. A steady decrease in standard error with increase of plot size was noted. Long narrow plots laid out along the rows had an advantage over plots of the same shape laid out across the rows, this being partly due to the nature of the fertility gradient and partly to the method of sowing a constant amount of seed to each row. More of the soil heterogeneity was eliminated with square than with rectangular blocks ; shape was found to be the most important factor in determining efficiency when the blocks were $\frac{1}{25}$ acre or larger. As most of the soil fertility variation was in one direction, a Latin square lay-out had no advantage over a randomized block lay-out with blocks laid across the direction of fertility variation. Optimum lay-outs for different types of experimentation are discussed, and a table given to facilitate determination of the amount of land and number of replications required for a given accuracy with different plot sizes. As an example, in the Institute's experiments in which plots of $\frac{1}{100}$ acre with a breadth-length ratio of 1 : 2 are employed, a standard error of 4 per cent is to be expected with six replications. J. W.

359. Hansford, C. G. 633.51–2.3–1.521.6:575.42

Black arm disease in Uganda.

E. Afr. Agric. J. 1935 : **1** : 131–34.

The general characteristics and behaviour of this bacterial disease of cotton are reviewed. Infection takes place through the leaves and the disease only becomes serious when it spreads to the stem.

A number of strains of cotton have been isolated, chiefly from the South African U4. strain, shewing resistance, in some cases to leaf infection, while in others leaf infection takes place but the disease does not spread to the stem. Care must be taken, however, to select each year the more resistant forms, as susceptible forms continue to appear in the strains selected for resistance.

360. 633.51:677.21:575.12

Ramanatha Iyer, V. 633.51:575.74:575.41

Deterioration in the quality of Cambodia cotton.

Madras Agric. J. 1935 : **23** : 321–27

Among the factors that contribute to deterioration in the quality of a strain of cotton are mentioned hybridization with inferior varieties and the play of natural selection on factors which may have been left impure when the strain was selected and which have a modifying effect on the economic characters. Neither of these however are considered to have occurred in this case, nor does the author consider that Cambodia cotton has in actual fact deteriorated.

361. NARASINGA RAO, M. B. V. 633.524.3:576.312.35
Chromosome numbers in two species of *Hibiscus* (*H. sabdariffa* L. and *H. cannabinus* L.).
Curr. Sci. 1935 : **4** : pages 162, 175.
In root tips of a pure line of *H. cannabinus* and of several varieties of *H. sabdariffa* the somatic metaphase plates shewed 2n = 72. Certain morphological differences in the chromosome complements of the two species were observed and mitosis exhibited periodicity.

SUGAR PLANTS 633.6

362. 633.61:00.14
ROSENFELD, A. H. 633.61:575
The nomenclature and genetics of sugar cane seedlings.
Int. Sug. J. 1935 : **37** : 341–46.
This brief compilation of information acquired during many years work on sugar cane varieties provides the layman and sugar cane planter with information on the botanical position and specific characters of the genus *Saccharum*, on the meaning of the initials denoting the place of origin of canes in various parts of the world, and on the parentage of the seedlings most commonly used by breeders.
A bibliography is included for those requiring further information.

363. 633.61:575(54.8)
Sugar cane breeding in India. Work at Coimbatore.
S. Afr. Sug. J. 1935 : **19** : 491–93.
Extracts from the account recently reviewed (Cf. " Plant Breeding Abstracts," Vol. VI, Abst. 69).

364. DUTT, N. L. 633.61:575(54.8)
Recent advances in sugarcane breeding in India.
Poona Agric. Coll. Mag. 1935 : **27** : 7–13.
This paper has been reviewed already (cf. " Plant Breeding Abstracts," Vol. VI, Abst. 69) from another source.

365. DUTT, N. L. 633.61:575(54.8)
A few characteristics of the thick type of canes evolved at Coimbatore.
Poona Agric. Coll. Mag. 1935 : **27** : 14–16.
The breeding of the thick type of canes is a recent activity of the Imperial Sugar Cane Station, Coimbatore. Such canes are numbered Co. 358 to 365 or Co. 400 to 499. They belong to *Saccharum officinarum* and taxonomically are distinguished by their inflorescence rather than by their thickness of stem. In relation to commercial varieties of sugar cane, however, the term " thick " is used to imply certain cultural requirements, e.g. in the case of the thick Co. canes, the need for irrigation facilities and relatively better type of cultivation and manuring than the medium canes.
The thick canes bred at Coimbatore are more resistant to drought and disease than the majority of thick canes and are divided into two classes, those suitable for tropical parts of India and those suitable as semi-irrigated canes for North India.

366. 633.61:575(72.9)
633.61–2–1.521.6(72.9)
Varietal problems in the West Indies.
Int. Sug. J. 1935 : **37** : 338–40.
A composite summary of the bulletin and report reviewed in " Plant Breeding Abstracts " Vol. V, Abst. 885 and Abst. 367 below.

367. McIntosh, A. E. S. 633.61:575(72.9)
Report on the sugar cane breeding problems of Antigua, Trinidad and St. Kitts.
Bull. B.W.I. Sug. Cane Breed. Sta. 1933 : No. 1 : Pp. 20.
McIntosh, A. E. S.
Report on the sugar cane variety problems in St. Lucia. Derived from a visit during April, 1934.
Bull. B.W.I. Sug. Cane Breed. Sta. 1934 : No. 2 : Pp. 8.
McIntosh, A. E. S.
Report on a visit to Jamaica, June, 1934.
Bull. B.W.I. Cent. Cane Breed. Sta. 1934 : No. 3 : Pp. 26.
McIntosh, A. E. S.
Report on a visit to Grenada.
Bull. B.W.I. Cent. Cane Breed. Sta. 1934 : No. 4 : Pp. 8.

Visits were paid to the islands mentioned to study the conditions of sugar cane growing with a view to meeting their requirements in varieties. The soil, climate, growing season, diseases and pests and other factors influencing the choice of variety are described, and preliminary schemes of work are suggested. Future breeding work in Barbados will have the requirements of the different islands in consideration and the provisional suggestions will be modified or adhered to according to the results obtained.

368. McIntosh, A. E. S. 633.61:575(72.98)
An account of the policy and methods employed in the breeding and initial stage of selecting sugar cane seedlings.
Bull. B W. I. Cent. Sug. Cane Breed. Sta. 1935 : No. 6 : Pp. 19.

The early progress of sugarcane breeding in Barbados is reviewed (Cf. " Plant Breeding Abstracts," Vol. III, Abst. 14). Controlled pollinations are exclusively used now, arrows of the seed parent being protected by an " arrow lantern " and dusted with arrows of the male parent, male-sterile varieties being used as seed parents. The technique employed, including the growing of the parent varieties, determination of their " sex," the pollination methods, and the methods of harvesting, sowing, potting and transplanting the resulting seedlings, is described in detail. To determine the value of varieties as parents, and of the different crosses, the seedlings resulting from the experimental crosses are randomized in the first year seedling block and at reaping some 10–12 months later the weight, per cent sucrose in the juice, length, width and number of canes and number of rotten canes are measured. Crosses which give promising results are then promoted to proven crosses, to which about 60 per cent of the seedling block is devoted, and from which seedlings of commercial value are expected. In this way too, the value of the respective varieties in breeding is discovered. Each year the number of proven crosses is added to from the experimental crosses, while the less promising of the latter are discarded.

Crosses have been carried out between Barbados noble varieties, between Barbados and imported noble varieties, further nobilizations of second and third Java " glagah " nobilizations, with Barbados varieties and on a small scale, nobilizations of Chunnee (*S. Barberi*) and Uba (*S. sinense*).

Two alterations are envisaged for future work, viz :—(1) first nobilizations of wild sugarcanes and (2) the testing of all first year seedlings under a full West Indies growing season of 15–17 months instead of the 10–12 months used so far. The object of these two changes is to ensure that types will be obtained suited to the West Indies growing season, which is longer than that of Java.

The policy employed has undergone changes in recent years. In 1928 the problem was to obtain types suited respectively to the high and low rainfall conditions of Barbados. In 1929–30 gumming disease spread rapidly in Barbados and the production of resistant forms became necessary. The creation of the British West Indies Central Sugar Cane Breeding Station in 1932 widened the range of seedling requirements, which now includes forms suited to growth under poor conditions, or under conditions where mosaic disease or froghopper are dominant factors ; for such forms crosses with wild species will be necessary.

369. 633.61:575(94.3)

Sugar cane breeding.

S. Afr. Sug. J. 1935 : **19** : p. 457.

Another brief note on the development of sugar cane breeding in Queensland. (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 886.)

370. VENKATRAMAN, T. S. 633.61:575:581.5(54.7)

Breeding sugarcanes to suit special tracts.

Poona Agric. Coll. Mag. 1935 : **26** : 134–36.

On the importance of breeding canes for special growth conditions peculiar to different localities. An outline of the work of the Imperial Sugarcane Station at Coimbatore which has been concerned in the collection, study and breeding of canes for sub-tropical Northern India, and has been accumulating data on the morphological and physiological features of canes growing in various tracts in that region.

The value of introducing wild species in hybridization work is mentioned.

371. 633.61:575.127.5:633.174
633.61–2.7–1.521.6:575

H. M. L(EAKE)

Some gleanings from the United States.

Int. Sug. J. 1935 : **37** : 376–78.

Among a number of articles dealing with the sugar cane in the United States, a number of which have already been reviewed, (cf. " Plant Breeding Abstracts," Vol. VI, Absts, 213, 214), the following refer to work in connexion with breeding and varieties :–

U.S. Dep. Agric. Yearbook of Agriculture, 1935 : p. 311.

An account is given of the efforts made to cross sugar cane with plants of other genera from Wray's experiments in 1848, who employed both maize and sorghum, to those of Venkatraman, who successfully crossed cane with sorghum, and Barke, who was successful with *Erianthus* sp.

Sugar Bulletin, 1935 : 13 : No. 11.

The differential resistance of sugar cane varieties to borer is held by T. E. Holloway to be only partly due to hardness. Resistance is, in part, inherited. POJ 213 is very susceptible and has Louisiana Purple, a susceptible variety, in its parentage ; POJ 36M is resistant and has the resistant Louisiana Striped in its parentage. Unfortunately, the newer varieties are derived from POJ 213. H. M. L.

372. HILL, A. G. 633.61:581.165.01:575.42

The maintenance of first-year characters in new sugarcane clones.

Bull. Dep. Agric. Mauritius 1935 : No. 8 : Pp. 7.

The weight per stool and percentage of total solids in the juice were determined for 48 first year seedlings which had been selected for high values in these characters, and also in the second year clones derived from them. Weight per stool shewed an average decline of 57 per cent and a low correlation between the first and second year plants, while total solids per cent of juice shewed very little falling off and a high correlation ($+ 0{\cdot}415 \pm 0{\cdot}037$).

In 166 of the seedlings, number of canes per stool was also studied in the two years, and was found to behave like weight per stool, weight per stool being largely determined by the number of canes per stool, as shewn by a high correlation ($+ 0.671 \pm 0{\cdot}028$) between the two characters in the first year seedlings.

It is suggested therefore that newly produced seedlings might be allowed to settle down for one or two seasons before attempting to assess quantitative characters.

373. BELL, A. F. 633.61:578.082.1(94.3)

A new quarantine house.

Cane Growers' Quart. Bull. 1935 : **3** : 27–28.

Also Qd. Agric. J. 1935 : **44** : 255–56.

A photograph and description are given of a new insect-proof glass house for the reception of new cane varieties imported by the Bureau of Sugar Experiment Stations from overseas.

374. HANSFORD, C. G. 633.61–2–1.521.6(67.61)
Sugar cane diseases in Uganda.
E. Afr. Agric. J. 1935 : **1** : 25–28.

The most important disease has been mosaic disease, to which "Striped Ribbon," the most widely grown variety, was susceptible. The problem has been solved by resistant varieties, in particular P.O.J. 2725.

Other diseases of minor importance are red stripe disease (*Bacterium rubrilineans*) top rot (cause unknown) and leaf spot diseases caused by *Cercospora* or *Helminthosporium*. Root diseases are practically non existent.

375. MCINTOSH, A. E. S. and STEVENSON, G. C. 633.61–2.3–1.521.6:575(72.98)
Gumming disease investigations in Barbados.
Bull. B.W.I. Cent. Sug. Cane Breed. Sta., 1935 : No. 8 : Pp. 17.

Gumming disease (*Bacterium vascularum* (Cobb) Grieg Smith) was first officially identified in Barbados in 1929 and in 1930 was found to have spread in susceptible varieties all over the island. As the variety Ba. 11569 which made up about 60 per cent of the acreage under sugar cane shewed marked development of the leaf symptoms it became evident that control measures were necessary, which, according to experience with the disease in other countries, could only be the growing of resistant varieties.

The symptoms of the disease are described. In Barbados canes are only occasionally killed by the disease, which suggests that either a less virulent strain is present or that the conditions are unfavourable to the development of the disease, or possibly both.

Experiments shewed that the amount of leaf infection could be taken as an index of the systemic infection, though the two were not exactly parallel. Leaf symptoms were accordingly used as indications of resistance or susceptibility in resistance trials which are now made as a matter of routine in the testing of new seedlings in the second year multiplication plot.

Degree of resistance was found to be a well marked varietal characteristic. Seedlings derived from *Saccharum spontaneum* L. and *S. Barberi* Jesw. by crossing with *S. officinarum* L. were practically all resistant to the disease and there was an appreciable percentage of resistant varieties of *S. officinarum*. In the latter there were differences in the resistance of seedlings derived from different lines, but in no case was freedom from leaf symptoms found, as was often the case in the other groups of seedlings. It appears that immunity will not be obtained in pure noble canes, but many such seedlings have shewn possibilities of a very high commercial resistance, sufficient to get rid of the disease.

The results obtained are being put into practice in breeding work in regard to the selection of suitable parents for the production of new varieties resistant to the disease as well as being commercially valuable.

376. 633.61.00.14(51.4)
633.61:575(51.4)
Research in the Philippines. Report of the Research Bureau, Philippine Sugar Association, for 1932-33.*
Int. Sug. J. 1935 : **37** : 258–59.

The variety trials carried out by the Agronomy Department are outlined and certain promising new canes are mentioned.

Details are given of the Cane Breeding Department's investigations in which special attention is paid to the sugar content and Brix determinations of the seedlings.

A variety census has been taken for 1933-34.

* Full details of the work summarized in this report and a resumé of the entire activities of the Research Bureau are given in the monthly reports of the Philippine Sugar Association, which are filed in the Bureau of Plant Genetics, and are available to those interested.

377. Sethi, D. R. and Khanna, K. L. 633.61.00.14(54.1)
A summary of the performances of some important Coimbatore sugarcane seedlings in Bihar and Orissa.
Agric. Live-Stk. India 1935 : 5 : 199–217.
This summary of the performance and probable economic value of a large number of seedlings is intended to be of use as a basis for future work at Coimbatore and at other Indian research stations engaged in the evaluation of cane types in relation to environment.

378. Williams, C. H. B., 633.61.00.14(88)
Follet-Smith, R. R. and Cameron, C. 633.61:575(88)
Field experiments with sugar cane, IV.
Sug. Bull. Dep. Agric. Brit. Guiana 1935 : No. 4 : Pp. 121.
Extensive variety trials have shewn that Diamond 10, a local variety bred by Plantation Diamond, and P.O.J. 2878 outyield by about 25 per cent (sucrose per acre) D. 625, the staple variety of British Guiana ; further information is needed on the behaviour of P.O.J. 2878 as second ratoons before the relative value of the two can be estimated accurately.
Several newly bred seedlings, of different parentages, have proved markedly superior to D.625 in their first tests and some have exceeded the yields of Diamond 10 and P.O.J.2878. In view of the high performance of the last-named varieties, the breeding problem is now to produce varieties which will be superior to them rather than D.625.

379. 633.62:582
Snowden, J. D. 633.15:582
A classification of the cultivated sorghums.
Kew Bull. 1935 : No. 5 : 221–55.
An outline of the proposed revised classification of the cultivated sorghums.

STIMULANTS 633.7

380. Kashi Ram. 633.71:581.162.3
Some observations on the seed-setting in a type of tobacco.
Indian J. Agric. Sci. 1935 : 5 : 355–57.
Pusa Type 56 tobacco forms comparatively few capsules during December and January but the number steadily increased until the end of the flowering period in April. Reciprocal crosses with Pusa Type 63, which has normal setting, indicated that the ovary is probably receptive throughout, but that the pollen does not function satisfactorily until the end of the season. It is possible that this is conected in some way with the increase in length of day and the rise of temperature in the later months. B. P. P.

381. Wilson Mayne, W. 633.73–2.452–1.521.6:575
Annual Report of the Coffee Scientific Officer, 1934–35.
Bull. Dep. Agric. Mysore 1935 : No. 13 : Pp. 28.
Studies on resistance and susceptibility to leaf disease (*Hemileia*) are being carried out and it appears that resistance to strain I, shewn by a considerable proportion of Kent plants (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 582) is a simple Mendelian dominant character. Resistance to strain II is more obscure in nature, and is only found in association with resistance to strain I on plants which are probably of hybrid origin. Selfing of completely resistant plants has given in one case three types of progeny viz., completely resistant, resistant to strain I only and completely susceptible, in another case only two types were obtained viz., completely resistant and completely susceptible.
It would be possible now with the material available to plant an isolated seed garden which would give plants shewing uniform resistance to the disease.
Work is in progress to determine whether differences in disease resistance are correlated with differences in productivity.

382. POUND, F. J. 633.74:581.162.3
A note on a method of controlled pollination of cacao.
4th Ann Rep. Cacao Res. Trinidad (1934) 1935 : 15–16.
For isolating flowers in controlled pollination a short glass tube 1″ in diameter with one end covered by gauze is used ; this simple apparatus is fixed to the branch with plasticine.
Evidence is presented, however, to shew that except for very critical work the amount of cross-pollination is low enough to be negligible even in unprotected flowers.

383. POUND, F. J. 633.74:581.162.5.02
Studies of fruitfulness in cacao. V. Conditional self-compatibility and its implications.
4th Ann. Rep. Cacao Res. Trinidad (1934) 1935 : 17–19.
Observations on certain cacao trees shewed that while at times they were self-incompatible, at other times and under different environmental conditions they became self-compatible. It is therefore considered doubtful whether trees that are genetically incapable of self-compatibility really exist, the distinction being rather between trees of greater or less self-compatibility.
The discovery of this phenomenon of conditional self-compatibility explains certain observations which had previously appeared anomalous, such as the fact that trees which had been noted as self-incompatible could on occasion set fruit to a greater extent than could be accounted for by natural cross-pollination.
Continuous self-compatibility is desirable from the point of view of yield, and observations are in progress to determine the possible effects of mineral nutrition on self-compatibility.

384. 633.74:581.321.1:575.113.7
POUND, F. J. 633.74:581.162.5
Studies of fruitfulness in cacao. VII. Ovule loss at fertilisation.
4th Ann. Rep. Cacao Res. Trinidad (1934) 1935 : 26–32.
By dissection of ovaries six days after pollination, the numbers of sound and aborted ovules were counted, about 30 ovaries being so examined for each of several crosses. Statistical analysis of the results shewed that there were different types of loss ; one, termed " abnormal," in which the number of ovules failing per ovary was high, was very irregular in occurrence; another termed " normal," occurred more regularly and here the number of ovules failing was usually 0 or 1 per ovary. Among the " normal " losses three types could be distinguished, one causing an average loss of 3·75 per cent, another 9·56 per cent and the third 12·66 per cent. The " abnormal " losses usually caused 20–30 per cent failure of ovules.
The distributions of the " normal " losses corresponded well with Poisson series, and it is suggested that they are due to genetic lethal factors. From the point of view of variance of bean number, however, the " normal " losses are less important than the " abnormal," due to insufficiency of pollen grains, or physiological factors. Losses also are known to occur at later stages of development.

385. 633.74–1.557:575
633.74–2.483–1.521.6
POUND, F. J. 633.74–2.2
The progress of selection, 1934.
4th Ann. Rep. Cacao Res. Trinidad (1934) 1935 : 7–11.
Descriptions are given of 36 selected cacao trees. It is hoped that by the end of the 1934–35 crop over 100 will be found which yield at the rate of at least one ton per acre, and that final selections will be concluded.
Tests are also being made on resistance to Witches' Broom disease (*Marasmius perniciosus* Stahel) and hybrid progeny are also to be raised.

386. POUND, F. J. 633.74–1.557:581.162.5
Certain barren types of cacao.
4th Ann. Rep. Cacao Res. Trinidad (1934) 1935 : 11–15.
Commercially valueless types of cacao trees include " male trees," so-called because they produce little or no fruit. This may be due to self-incompatibility (See Abst. 383) or to sterility, in which

case the female and usually the male organs of the flower are abnormal ; sterile trees usually set fruit in profusion but no seeds are formed.
Another type is the small podded tree which produces heavily, but the pods are very small and the beans difficult to extract.

387. VOELCKER, O. J. 633.76:581.48:575
Cotyledon colour in kola.
Trop. Agriculture Trin. 1935 : **12** : 231–34.
A brief introductory description of *Cola nitida* is followed by details of a preliminary study of the incidence of colour in the cotyledons, the parts of the kola nuts visible when the cartilaginous skin has been removed before storage. Three plots planted with trees bearing red, white and pink nuts respectively were under observation and after the technique of controlled pollination had been investigated, various crosses were made.
The " nuts," being cotyledons, represent the filial generation. From the observations on the three plots, pure white appears to be recessive, whilst colour is probably a complex character conditioned by a number of genes.
The close parallel between the author's results with kola and those of Wellensiek for cotyledon colour in cacao is noted. (Cf. " Plant Breeding Abstracts," Vol. II, Abst. 485).

388. SALMON, E. S. 633.79:575(42)
Eighteenth report of the trial of new varieties of hops.
J. Inst. Brew. 1935 : **41** : 398–402.
A total of 238 varieties including a large number of new ones of which the parentage is given were tested in 1934. Particulars are given of the yields, number of bushels per cwt., resin contents and the incidence of disease in the gardens.
Eight new varieties gave a crop exceeding 30 cwt. to the acre and forty others a crop of 25 cwt. or over. Among the late varieties, OZ79, OY35, OD31, (all three being " New Mexican Seedlings,") gave yields of $36\frac{1}{4}$, $35\frac{1}{4}$ and $34\frac{1}{4}$ cwt. respectively. Among the mid-season varieties R1/9 (a " Manitoba Seedling ") gave $29\frac{1}{4}$ cwt. per acre and has also remarkable preservative properties ; it is now to undergo brewing tests. In the early mid-season and late classes certain new productions proved to be richer in preservative qualities that any of the commercial forms ; and in 1934, as in the two previous seasons the new hop C9a (" Brewers Gold ") was probably superior in this respect to all other hops in the world, while varieties 411 and Q43 surpassed the richest available sample of American hops.

CAPSICUM 633.842

389. RAMIAH, K. and RAYAPPA PILLAI, M. 633.842:575.11
Pungency in chillies (*Capsicum annum*). A Mendelian character.
Curr. Sci. 1935 : **4** : 236–37.
Crosses between the wild, small fruited and very pungent variety of *Capsicum frutescens* and the cultivated variety with large, non-pungent fruit gave a pungent F_1 and of the 25 F_2 plants grown 18 had pungent fruits and 7 were non-pungent.

OIL PLANTS 633.85

390. JOHN, C. M. 633.853.74:575.11
Inheritance studies in gingelly—*Sesamum indicum*.
Proc. Ass. Econ. Biol. Coimbatore (1934) 1935 : **2** : 33–40.
Flowering and the method of pollination are briefly described.
Flower and fruit characters which were found to be determined by single factors were : purple corolla (*C*) dominant over " white purple wash " corolla (*c*), purple line of dehiscence in the white anthers (*P*) dominant over no purple line (*p*), but only expressed in the presence of (*C*), purple at the base of the style (*Cs*) dominant over colourless base of style (*cs*), one flower in the axils of the leaves (*S*) dominant over several (1–3) flowers in axils (*s*) ; a ndfour-loculed capsule dominant over four to eight-loculed capsule.

TANNING PLANTS 633.87

391. 633.879:576.312.35

NEWMAN, I. V. 633.879:581.3:581.4

Studies in the Australian *Acacias* III. Supplementary observations of the habit, carpel, spore production and chromosomes of *Acacia Baileyana* F.V.M.

Proc. Linn. Soc. N.S.W. 1934 : **59** : 237–51.

Detailed observations on the sporangial and other structures of the flower and fruit are given.
The gametic number of chromosomes in *Acacia Baileyana* was confirmed as 13 which is regarded as being derived from two sets of 7 by fusion of two chromosomes to form one large one.
The theory of Huskins that meiosis is initiated by suppression of the telophase split in the last pre-meiotic mitosis is to be tested in this material, which is suitable for the purpose.

392. 633.879:581.3

NEWMAN, I. V. 633.879:575.24:581.01

Studies in the Australian *Acacias*. IV. The life history of *Acacia Baileyana* F.V.M. Part 2. Gametophytes, fertilization, seed production and germination and general conclusion.

Proc. Linn. Soc. N.S.W. 1934 : **59** : 277–313.

A very detailed account is given of the development of the gametophytes, fertilization, embryo development and seed formation and germination in *Acacia Baileyana*. Evidence of polyspermy is presented, resulting in the formation of endosperm with more than 39 chromosomes.
It is suggested that the high degree of variability of *A. Baileyana* may be due to the long dormancy of the seed, as suggested by Navashin (" Plant Breeding Abstracts," Vol. III, 552).

RUBBER PLANTS 633.9

393. 633.912:575

MANN, C. E. T. 633.912:581.165

Recent progress in the selection of planting material of *Hevea*.

J. Rubb. Res. Inst. Malaya 1935 : **6** : 21–34.

A review of the value of material from controlled crosses in comparison with seedlings from uncontrolled pollination and with clonal material.
The work of Heusser in Sumatra, Morris in Malaya and Chittenden indicates that " legitimate " seedlings from carefully selected parents may equal good clones in yield, though the best seedlings do not equal the best clonal trees.
In both Heusser's and Morris's work there was one tree or clone which was outstanding as parent, all its progeny being high yielding, but in neither case was this tree the most outstanding in the clonal material.
From exceptionally good individual seedlings produced by controlled crosses it is possible that superior clones may be produced by budding.
It has been suggested that by planting high-yielding clones in isolation and allowing free crossing between these, collections of seed may be obtained which will give results comparable to those obtained from controlled crosses. The author points out that owing to variations in time of flowering this may not be so, and suggests rather the collection of seed from parents of proven worth, such as are mentioned above.

394. 633.912:575(91)

Annual Report 1934.

Rep. Rubb. Res. Inst. Malaya 1935 : Pp. 175.

Test tappings have been performed on the seedlings resulting from crosses made in 1928 and shew that seedling families obtained by hand cross-pollination between high-yielding clones are likely to be very much superior in yield to ordinary seedlings of unknown parentage and may be as good or better than first class clones. Seedlings from some of the parents used in the crosses, but whose male parent was unknown (illegitimate seedlings) also gave promising results, though not as good as the legitimate seedlings. It is noteworthy that A44, the clone which was most successful

as a parent, was only sixth in respect of yield on the list of clones used. The variability in yield of illegitimate seedlings from mother trees was found to be intermediate between that of buddings and that of seedlings of unknown parentage.
Areas have now been planted with illegitimate seedlings from certain clones, seeds from monoclonal plantings and certain other types of tree for comparative study.
Correlation studies indicate that in tapping tests, the yield for the second five days of tapping may be taken as an index of the yield over the whole test period and also for successive tests periods, the early test at three years being sufficiently reliable as a basis of classification of the trees.
It has also been shewn that high yielding trees have large sieve tubes and low yielding trees small ones. Though the position with regard to medium yielding trees is not so clear it is possible that this criterion may serve as a basis of selection in the first year of life of a seedling.

395. 633.912–1.531.12:575.42
633.912:581.165

CRAMER, P. J. S.

Improved rubber seeds.

Trop. Agriculturist 1935 : **85** : 3-9.

A critical account of a lecture by J. S. Vollema on *Hevea* selection in West Java. The lecturer mentioned the increased yield obtained by monoclonal plantings, starting with a dense stand of 160–200 buddings per acre, afterwards reduced to 90–100 trees by selective thinning. He then considered the value of seedlings, which were divided into four classes according to the origin of the seed. The first class consists of seeds from fields in which the poorer yielding trees have been removed by thinning. This primitive selection results in a certain increase in yield. The second class consists of seeds from high yielding trees in ordinary plantings ; as these seeds arise from open pollination, the male parent may be good or bad, but average increases of about 30 per cent have been obtained by this method. From the third class, seeds from high yielding clones, especially from clones mixed with other high yielding clones rather than with ordinary seedlings, still higher yields are obtained. The last class, which the lecturer termed legitimate seeds, both of whose parents are known, consists of seeds obtained from artificial pollination or from seed producing fields where there is a mixture of not more than two clones, and has also given very high yields.
In general, plantings with seedlings, especially of the last class, may be expected to equal the yields of clonal plantings, and probably to surpass them, for with dense planting and thinning out seedling plantings offer more scope for improvement owing to their greater variability. The lecturer recommends that seed producing fields should be laid out, consisting of a mixture of 5 clones.
The author agrees in general with the lecturer's remarks, but questions his inclusion of seeds from mixtures of two clones in the class of legitimate seedlings and considers that better results are likely to be obtained from seeds taken from large monoclonal plantings than from mixtures of clones. He also suggests that secondary characters as well as yield should be taken into account in selecting seeds as these characters appear to be inherited. In growing plantings from seed, a drastic thinning could be performed, one out of 25–30 young plants being kept, leaving 200 per acre to allow further thinning out of the three-year-old trees on the basis of tapping tests.

396. GUNNERY, H. 633.912–1.557:581.44

Yield prediction in *Hevea*. A study of sieve-tube structure in relation to latex yield.

J. Rubb. Res. Inst. Malaya 1935 : **6** : 8–20.

The substance of this paper has already been reviewed (Cf. " Plant Breeding Abstracts," Vol. VI, Abst. 394). It is hoped that the position with regard to medium yielding trees will be clarified when their tapping behaviour is known over a number of years.
At present sieve tube size, owing to its development in the bark of one-year-old stems may afford a means of eliminating low-yielding individuals at a very early stage.
It is considered desirable to investigate this correlation between morphology and physiological behaviour genetically, in conjunction with a study of the chromosomes of the different types.

397. 634–1.421–1.557:519.241
635–1.421–1.557:519.241

STRICKLAND, A. G.

Error in horticultural experiments.

J. Dep. Agric. Vict. 1935 : **33** : 408–16.

Uniformity trial studies were made on grape vines, peach and apple trees, and tomatoes in order to study the nature of the variation in yield, and to reach conclusions regarding the best size (and in some cases shape) of plots for experimental work. It was found that tomatoes behaved like cereal crops in that the coefficient of variability did not decrease in proportion to the square root of the number of units aggregated as larger plots were formed. The other crops, however, seemed to follow this law. It is suggested that useful plot sizes are those allowing for 4 apple trees, 6–8 vines, 8 peach trees or 36 tomato plants. In Part II a trial designed to measure the variability in cool storage behaviour of sample cases of apples is reported on, and the results used as a basis for suggestions regarding storage experiments. J. W.

398. 634.14:581.162.32:581.6

The flowering quinces.

Gdnrs'. Chron. 1935 : **97** : 414–15.

A discussion on the classification of this group of quinces and on the identity of certain varieties, cross-pollination requirements and culinary qualities.

399. 634.441–1.541.11:581.481
634.3–1.541.11:581.163

GANDHI, S. R.

Recent changes in horticultural practices.

Madras Agric. J. 1935 : **23** : 280–82.

In connexion with stock and scion relationship, it is pointed out that the standardization of root stocks has been neglected in India. In mangoes and citrus varieties the phenomena of poly-embryony and apogamy respectively could be utilized to this end.

Reference is also made to the influence of genetical relationships on the compatibility of stock and scion.

400. 634.441–1.541.11:581.481
634.3–1.541.11:581.163

GANDHI, S. R.

Recent changes in horticultural practices.

Proc. Ass. Econ. Biol. Coimbatore (1934) 1935 : **2** : 53–55.

Abstract of lecture already reviewed (Cf. Abst. 399 above).

401. PATEL, J. S. and NARAYANA, G. V. 634.58:581.481

A rare instance of poly-embryony in *Arachis hypogœa*, Willd.

Curr. Sci. 1935 : **4** : 32–33.

Some records of poly-embryony in various plants and an instance actually observed by the writer in *A. hypogœa*, Willd.

402. LARTER, L. N. H. 634.771:575.127.2:576.312.35

Hybridism in *Musa*. I. Somatic cytology of certain Jamaican seedlings.

J. Genet. 1935 : **31** : 297–315.

The hybrids dealt with arose from the cross Gros Michel x Robusta (or Congo, *Musa Cavendishii* Lam.), though there is some possibility that the male parent was *M. acuminata*, a fertile diploid which was growing nearby. Robusta, however, is assumed to be the male parent.

Both parents were highly sterile triploids ($2n = 33$). The chromosomes were very small ($0{\cdot}5 - 1{\cdot}5\mu$ x $0{\cdot}2 - 0{\cdot}3\mu$) and an unusually high proportion of them bore satellites.

In the F_1 14 out of 15 seedlings were tetraploid ($2n = 44$) and one triploid, the former being considered to have arisen from the fertilization of triploid eggs in Gros Michel with haploid gametes from Robusta, while the triploid probably arose from the union of a diploid egg and a haploid male gamete.

F_1 plants were back-crossed to each parent and seedlings were obtained with chromosome numbers ranging from 32 to 77, including several aneuploid numbers. In the cross F_1 x Robusta the seedlings obtained were mainly triploid, though 32, 34, 41 and 44 chromosome types were also obtained; these are probably the result of eggs with 21-33 chromosomes fertilized with haploid Robusta pollen. From the cross Gros Michel x F_1 a greater variation in number was obtained, probably from diploid and triploid eggs fertilized by F_1 pollen varying in chromosome number from 11 to 22. The heptaploid form probably arose from a hexaploid (66) egg.
The only F_2 plant obtained had 34 chromosomes.
The conclusions arrived at regarding the chromosome numbers in viable pollen grains were supported by a statistical analysis of pollen grain sizes, assuming size to vary as the chromosome number. This study also indicated that the F_1 plants produced a certain amount of triploid pollen; the absence of hexaploids in the cross Gros Michel x F_1 is therefore attributed to differential pollen tube growth.

403. Sayed, I. A. 634.774:575.255:575.252
Chimera in pineapple.
Curr. Sci. 1935 : **4** : p. 263.
A pineapple plant is described which combined the characters of the two varieties Queen and Kew. In explanation, it is suggested that the two varieties have arisen from a common stock and are able to mutate in either direction under favourable conditions.

VEGETABLES 635

404. 635.63:581.143.26.03
Burr, S. and Turner, D. M. 635.64:581.143.26.03
Vernalisation of tomatoes.
Gdnrs' Chron. 1935 : **98** : p. 288.
Four groups of tomato seeds of the variety Ailsa Craig were vernalized on November 15th, 1934 for 7, 16, 32 and 44 days respectively at a temperature varying between 1°C. and 3°C. The seeds were then stored in the laboratory and sown on January 1st, 1935. It was found that the treatment had reduced germination proportionally to the length of the treatment. The treated plants lagged behind the controls in growth, fruit setting, time of fruit ripening and weight of fruit borne.
In general, the plants from seed vernalized for 44 days were most vigorous but were definitely behind the controls in weight of fruit and earliness of fruit production.
A small amount of cucumber seeds of the variety Butcher's Disease Register was similarly treated. Germination was also reduced and the surviving plants were stunted, partially sterile and at least 14 days behind the controls.

635.64:576.356.5:575.129
405. Janaki Ammal, E. K. 635.646:576.356.5
Polyploidy in the genus *Solanum*.
Proc. Ass. Econ. Biol. Coimbatore (1934) 1935 : **2** : 50–52
The general characteristics of polyploid plants are briefly reviewed, and their production by decapitation of young tomato plants is described.
The author has discovered triploids in *Solanum melongena* arising from chromosome doubling in the male gametes. Their meiotic behaviour offers evidence in support of Darlington's views on chromosome pairing.
The importance of amphidiploids in giving rise to new species is mentioned.

406. Rangaswami Ayyangar, G. N. and Krishnaswami, N. 635.652(54.8)
A new variety of black gram or *Urid* (*Phaseolus mungo*, Linn.).
Curr. Sci. 1935 : **4** : p. 32.
The habit and morphological characteristics of this purple podded type from Malabar are enumerated.

407. 635.654:575.11

RANGASWAMI AYYANGAR, G. N. and KUNHI KRISHNAN NAMBIAR, K.

Studies in *Dolichos lablab* (Roxb.) and (L.)—the Indian field and garden bean. I.

Proc. Indian Acad. Sci. 1935 : **1** : 857–67.

A general description of the uses, morphology and floral behaviour of the bushy field varieties and the twining garden varieties is given.

Cross-pollination is performed in the bud, immediately before dehiscence of the anthers of the seed parent, the pollen of the male parent being applied in the keel tube of the latter, which is slipped over the stigma.

The inheritance of a number of characters was studied. Monohybrid segregation was observed in the following characters, the first named being dominant in each case : (1) downward disposition of hairs (*H*) on internodes in garden varieties versus upward (*h*) in field varieties ; (2) medium width of pods (W_1), normal in field varieties versus narrow pods (w_1) ; (3) septate pods (*S*) in garden varieties versus non-septate pods (*s*) in field varieties ; (4) green pods and plant (*Ca*) in all field varieties and some garden forms versus light green pods and plant (*ca*) in garden varieties.

In crosses between forms with erect pods (field) and those with drooping pods (garden) 3 : 1 and 15 : 1 segregations were observed in different crosses, indicating the presence of two independent dominant factors E_1 and E_2, either or both of which produce erect pods.

408. RANGASWAMI AYYANGAR, G. N. and 635.654:581.48;575.11.061.6
KUNHI KRISHNAN NAMBIAR, K. 635.654:575.116.1

Studies in *Dolichos lablab* (Roxb.) and (L.)—the Indian field and garden bean. II.

Proc. Indian Acad. Sci. 1935 : **2** : 74–79.

There are three major seed coat colours in *Dolichos lablab* (Roxb.) and (L.), Khaki, Chocolate and Black, and a fourth colour Buff occurring in field varieties only. In the first three colours, pigmentation may be confined to the micropyle and certain other parts, or may be present over the whole of the seed coat ; but in the case of Buff only one type of pigmentation is found, in which the micropyle is colourless and the rest of the seed coat buff.

Genetically the character Buff was found to be *kkBfBf*, Micropylar Khaki *KKbfbf*, and Khaki (whole seed coat) *KKBfBf*, the factors *K* and *Bf* being absolutely linked. A third factor *Ch* produces Chocolate in combination with *K*, of which it is independent in inheritance.

409. CLAY, S. 635.656:575.11–18

Notes on the inheritance of quantitative characters in a cross between two varieties of garden pea (*Pisum sativum* L.).

J. Pomol. 1935 : **13** : 149–89.

The varieties used were a practically pure line known as " FB " and the commercial variety Little Marvel.

The characters investigated were pod breadth, seed weight, seed shape, percentage of two-flowered racemes, time of flowering and fruiting and foliage colour. As the experiments had plant breeding for their primary object the partial F_3 and later generations do not represent unselected samples and the genetical data must be judged accordingly.

Pod breadth, seed size, seed shape, foliage colour and percentage of two-flowered racemes all shewed a monohybrid segregation though there was evidence for modifying factors in each case. Earliness of flowering tended to be recessive but the inheritance is probably complex.

The characters examined, with the exception of foliage colour, were more or less associated in the hybrids as in the parent forms and some form of linkage is shewn to exist and its theoretical and practical significance is discussed.

410. SUTTON, E. 635.656:576.356.2:576.356.1
Half-disjunction in an association of four chromosomes in *Pisum sativum*.
Ann. Bot. Lond. 1935 : **49** : 689–97.

An account of chromosome association in an interchange heterozygote giving approximately half sterility. The two pairs of chromosomes concerned were sometimes associated to form a figure-of-eight by four terminal or subterminal chiasmata and an interstitial chiasma in one pair between the interchanged segment and the spindle fibre attachment point (centromere). This type of association leads to " half-disjunction," that is the formation of equal numbers of viable gametes and deficient, inviable gametes through chromatid non-disjunction, though centromeres disjoin regularly.

Other types of association found were chains of four, sometimes giving non-disjunction and sometimes regular disjunction and in two cases giving numerical non-disjunction, and open rings with adjacent centromeres going to the same pole. In a number of cases the multivalent was replaced by two bivalents.

The genetical consequences of these formations and the non-disjuncition arising from them are discussed.

Interchange homozygotes of the line studied give 75 per cent sterility and an association of six chromosomes when crossed either with the K or T line, shewing that the interchange is different from either of those in the lines mentioned, but has one chromosome in common with each.

411. 635.659:581.162.5:581.43
SINGH, T. C. N. 633:581.162.5:581.43
Sterility of crop-plants and a study of their root-system.
Curr. Sci. 1935 : **4** : 30–32.

A preliminary note on an experiment to elucidate the possible physiological basis of sterility in *Cajanus indicus* Spreng. Irrigation of groups of sterile plants with solutions of various salts of potassium or sodium and irrigation of the strong lateral roots of a further group with well water was followed after a couple of weeks by flowering. The control groups shewed no flowers.

Other crop plants are to be similarly tested.

Part II. Foreign

STATISTICS 519

412. 519.24
KRISTENSEN, R. K. 631.421
Om Variationsanalyse. I, II and III. (**On the analysis of variance. I, II and III**).
Tidsskr. Planteavl 1933 : **39** : 535–39 ; 1934 : **40** : 521–27 ; 1935 : **40** : 835–39.
In these articles the author is comparing R. A. Fisher's method of analysis of variance with his own elimination method. In the first he deals with data multiply classified, and shews how by successively calculating the deviations from the class means he is finally able to obtain an estimate of the random error variance, the division being identical with Fisher's degrees of freedom. In the second paper he illustrates the method of calculation by means of a number of examples; in the first, which is of the form of the Latin Square, though systematically arranged, he shews that both methods give identical results, as is in fact to be expected. In another example discrepancies are found, which appear to be due to the author's method of superimposing different classifications on the same original lay-out. He returns to Fisher's methods, and deals with the question of calculating the variance for the various categories into which the data can be divided. In the third paper he goes still farther in the direction of reconciling the two methods. He asserts that Fisher's variation scheme can be used to find the random error just as well as his own method, but the method of calculation must not be regarded as an actual variation analysis, since the expressions found for the various categories of variation do not give the correct picture of the magnitude of the variation.* J.W.

413. WILKS, S. S. 519.24
Test criteria for statistical hypotheses involving several variables.
J. Amer. Statist. Ass. 1935 : **30** : 549–60.
There are many cases where statistical methods are applied, in biological experimentation, in industry, and in social and economic problems, in which more than one variate is involved, yet the standard tests of statistical inference are only capable of dealing with one variate at a time. For a number of reasons it is desirable to have a single comprehensive test. The author describes the appropriate methods for a variety of hypotheses concerning the populations from which the various test data may be supposed to be drawn, and shews how the necessary tests of significance should be made. J. W.

414. KOLMOGOROV, A. 519.241:575.1:575.4
Deviations from Hardy's formula in partial isolation.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1935 : **3** (8) : 129–32.
Following upon the researches of Fisher and of Wright formulae are given for the evolution of a gene's concentration in partially isolated populations, such as are obtained when a population with a constant number of specimens N disintegrates into s partial populations containing S specimens each and free crossing occurs in each partial population and each generation gives k "roving" specimens which pass at random to some other partial population with which they cross. Formulae are given first for the absence of selection and then for a coefficient of selection a in the case of a recessive gene.

415. LOVE, H. H. 519.241.1
A table for transforming the correlation coefficient, r, to z for correlation analysis.
J. Amer. Soc. Agron. 1935 : **27** : 807–12.
A table is given for the conversion of r into the nearly normally distributed constant z suggested by Fisher. The values of r increase by intervals of 0·01 to 0·90 and then by intervals of 0·005 to 0·995, the corresponding values of z being given to four places of decimals.
The use of z for comparing correlation coefficients or estimating their significance is illustrated by examples.

*If, however, it is recognized that the block or treatment variance may be estimated by subtracting the error variance from the variance of the particular line of the analysis of variance table, and then putting it into the proper units, the two methods of calculation can again be reconciled. J. W.

416. MITSCHERLICH, E. A. 519.25:633.00.14
Die Verarbeitung landwirtschaftlicher und anderer biologischer Versuchsergebnisse. (**The treatment of agricultural and other biological experimental results.**)
Schr. königsb. gelehrt. Ges. naturw. Kl. 1934 : **10** : 199–229.
It is the author's contention that although a measure of accuracy is essential in all biological investigations, such measurements should not be carried too far and in all calculations superfluous labour should be saved.
Therefore, instead of the usual mean or probable error or fluctuation, the use of the "average fluctuation" is regarded as suitable.
Examples are given to illustrate the author's view.

GENETICS 575

417. GRÁBNER, E. 575:633
L'importance de la sélection des plantes pour le développement de la production agricole. (**The importance of plant breeding for the development of agricultural production.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Principal. Sect. IV : Thème No. 2 : Pp. 9.
The importance of plant breeding to agriculture is discussed and illustrated by the increases in the yield of cereals brought about in Hungary by the use of improved varieties. The author considers that increases in yield, as well as other valuable characters, should still be an aim in plant breeding, the present world crisis being due rather to under-consumption than to over-production.
To develop plant breeding so as to confer the maximum benefit on agriculture, the state should encourage private enterprise in this direction, not only by direct help, but also by protecting the interests of plant breeders in their products and ensuring them a return for their expense and labours. The solution of the problem of how this can best be done should be the object of international co-operation, the problem being one of international importance.

418. KOČNAR, K. 575:633
L'importance de la sélection des plantes pour le développement de la production agricole. (**The importance of plant breeding for the development of agricultural production.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial Tchécoslovaquie. Sect. IV : Thème No. 2 : Pp. 3.
After briefly mentioning the advantages derived from breeding, especially in the improvement of quality, the author stresses the need for a close relationship between the plant breeder and the cultivator.

419. SĂULESCU, N. 575:633
L'importance de la sélection des plantes pour le développement de la production agricole. (**The importance of plant breeding for the development of agricultural production.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial Roumanie. Sect IV : Thème No. 2 : Pp. 3.
A general discussion of the advantages to be derived from plant breeding, which are increase in yield, increased certainty of yield, extension of agricultural territory and improvement of quality.

420. SCHRIBAUX. 575:633
L'importance de la sélection des plantes pour le développement de la production agricole. (**The importance of plant breeding for the development of agricultural production.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Principal. Sect. IV : Thème No. 3 : Pp. 13.
The importance in plant breeding of the discovery of the laws of inheritance is outlined and it is pointed out that the most certain method of obtaining a plant combining all the desired characters is to grow as large progenies as possible.
The multiplicity of varieties existing to-day is considered prejudicial to the interests of agriculture, and concentration on the few best varieties is recommended ; at the same time it is realized that the numerous varieties are valuable as experimental material to the plant breeder.
The two aims of the breeder are quantity and quality of yield, and successes in these aims are mentioned in such crops as sugar cane, wheat and barley. Another important aim is to secure regular yields under varying conditions, which involves the production of forms resistant to adverse factors in the environment, such as frost, drought or disease. The breeding of disease resistant forms is briefly discussed, and its advantages over chemical methods of control are stressed.
In conclusion the author suggests that the slow progress of plant breeding has been due to the relegation of the study of heredity to a second place in schools of agriculture and laboratories, and he urges that the state should give every encouragement to plant breeders, whose activity, unprotected by patent laws, is not profitable to the breeders themselves, but is the most certain, rapid and economic method of reducing costs in agriculture.

421. 575:633
STEHLIK, V. 633.63:575
L'importance de la sélection des plantes pour le développement de la production agricole. (**The importance of plant breeding for the development of agricultural production.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial Tchécoslovaquie. Sect. IV : Thème No. 2 : Pp. 5.
The chief point which the author stresses is the side-by-side development of agricultural methods and of plant breeding, the full advantage of the new methods of cultivation, fertilization of the soil and so on having only been derived by the use of improved and more exacting varieties of plants. This is illustrated with reference to sugar beet and other plants.

422. 575:633(43)
633.1:575(43)
KONOLD, O. 631.521.1(43)
Pflanzenzüchtung und Saatbau im Gebiet der Freien Stadt Danzig. (**Plant breeding and seed culture in the territory of the Free City of Danzig**).
Veröff. Landw. Inst. Techn. Hochschule Danzig 1934 : No. 7 : Pp. 35.
On three plant breeders, Jakob Epp, Franz Bensing and Emil Wiebe of the Danzig area and their part in the production of new improved types of wheat and barley whose performance is described. The pamphlet also contains a section devoted to the organization, functions and work of the Seed Culture Association in Danzig. Another section deals with the improvement of *Lathyrus* as a fodder plant.

423. KOSTECKI, E. 575:633(43.8)
Importance de la sélection des plantes pour le développement de la production agricole. (**The importance of plant breeding for the development of agricultural production.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial Pologne. Sect. IV : Thème No. 2 : Pp. 4.
The organization for the voluntary control of improved seed in Poland is described. There are six Regional Seeds Divisions, controlled by a Central Seeds Division, and seeds certified by these voluntary bodies are allowed certain privileges by the Government, such as cheap transport on the railways. The system is considered to be more satisfactory than regulation by law.

424. 575:633(44)
633–2–1.521.6:575(44)

Le Centre National de Recherches Agronomiques de Versailles. (**The Versailles National Centre for Agronomic Research**).
Inst. Rech. Agron., Minist. Agric. Versailles 1934 : Pp. 12.

This publication contains a brief statement of the activites of the Central Station for the Improvement of Crop Plants, with citations of literature, the more relevant items of which have been reviewed in " Plant Breeding Abstracts."
There is also a note on the Central Station for Plant Pathology. Experiments in Alsace have resulted in the discovery of a number of wart resistant varieties of potato, and work on Japanese chestnuts has shewn that they are adaptable to French conditions and could be used to replace native varieties in France susceptible to ink disease. In varietal tests, eleven varieties of gram have been found to be resistant to anthracnose (*Ascochyta Rabiei*) and one dwarf French bean, " Nain abondant " is resistant to halo blight.
A type of lettuce resistant to *Sclerotinia Libertiana* has also been discovered.
Resistance studies of various crops are still in progress.
The laboratory of cereals and flours is engaged in a study of existing methods of estimating quality in wheat and flour with a view to co-ordinating, simplifying and improving techniques.

425. Brétignière, M. L. 575:633(44)

L'importance de la sélection des plantes pour le développement de la production agricole. (**The importance of plant breeding for the development of agricultural production.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial France. Sect. IV : Thème No. 2 : Pp. 5.

The importance of plant breeding is discussed from the economic point of view, the author pointing out that the more regular yields which could be obtained by the use of varieties resistant to adverse factors afford a means of averting economic crises due to price fluctuations. Although in recent years the apparent over-production in agriculture has led breeders to devote more attention to quality, the problem of increasing quantity is still present.
The need for careful, unbiassed and quick testing of improved forms is stressed, as well as the need for protecting the interests of the breeder.
The breeding aims in France with respect to the chief crops are briefly summarized.

426. Frandsen, H. N. 575:633(48.9)

L'importance de la sélection des plantes pour le développement de la production agricole au Danemark. (**The importance of plant breeding for the development of agricultural production in Denmark.**)
XVI Congr. Int. Agric. Budapest 1934: Rapport Spécial Danemark. Sect. IV: Thème No. 2 : Pp. 6.

The increases in yield per hectare during 40 years, of wheat, two-rowed barley, forage beet and turnips are given. Among the many factors that have contributed to these increases, the improvement of varieties has played a considerable part.

427. Broekema, J. C. 575:633(49.2)

L'importance de la sélection des plantes pour le développement de la production agricole. (**The importance of plant breeding for the development of agricultural production.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial Pays-Bas. Sect. IV : Thème No. 2 : Pp. 4.

The introduction of improved races of crop plants, in addition to its direct effect of an increase in profits, has an important reaction on agricultural technique in general, new and improved techniques being necessary to get the best results from the improved races. Conversely, the improvements in technique which have been introduced in the last 60–80 years have only been profitable because of the concurrent introduction of better races of plants.
This development of agriculture has had an important effect on the welfare of agriculture and of the people in general.

428. PAVLOFF, K. 575:633(49.7)
L'importance de la sélection des plantes pour le développement de la production agricole. (**The importance of plant breeding for the development of agricultural production.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial. Sect. IV : Thème No. 2 : Pp. 1.
Plant breeding has only been in progress in Bulgaria for 15 years, but already improved varieties of wheat, oats, cotton, etc. have been produced which are preferred by the growers and in some cases have completely replaced the land varieties.
The work, which is carried on almost entirely by State stations, consists of selection and hybridization, the native species being used for the most part, though exotic forms are also used in crosses.

429. 575:633(51)
Improved varieties developed through the cooperative crop improvement project of the University of Nanking.
Spec. Rep. Coll. Agric. and For. Nanking 1935 : No. 2 : Pp. 17.
The characteristics and performances of the following are described : Nanking 2905 wheat, Kaifeng 124 (= Sallee) wheat, Nanhsuchow 61 wheat, the soya bean Nanksoy 332, and the Chinese cotton Million Dollar, all derived from selections from farmers' fields, Kaifeng 313 barley, of unknown origin, and Trice and Acala, acclimatized American varieties of cotton.

430. OPPENHEIMER, H. R. 575:633(56.9)
The present state of botanical, horticultural and sylvicultural research in Palestine.
Palest. J. Bot. Hort. Sci. 1935-36 : **1** : 8–21.
A review of work done by Palestine workers, or by others on subjects relating to Palestine, with a bibliography of 103 references. A few works on plant breeding topics are mentioned, in cereals and citrus fruits.

431. 575:633(73)
Yearbook of Agriculture 1934.
Yearb. U.S. Dep. Agric. 1934 : Pp. 783.
In sugar beet, varieties resistant to leaf-spot and curly-top respectively are to be introduced.
The production of an Egyptian type of cotton affords a means of utilizing the acreage made available by certain irrigation schemes (especially Boulder Dam) without adding to the problem of crop surpluses, as it does not compete with the cotton now produced in the U.S.A. The only Egyptian variety grown to any extent in the U.S.A. is Pima, a highly productive variety with long lint, but the somewhat shorter but strong and fine lint of Sakel is in demand for certain manufactured products. From a cross between the two, a variety provisionally termed S x P, has been produced which combines many of the better features of both, though the lint length is somewhat less than in Pima. The new variety is not expected to replace Pima, but is likely to be useful in satisfying those needs of the textile industry to which Pima is not suited.
New varieties of barley, oats, wheat and flax introduced by the Department of Agriculture are proving successful and in maize, parent lines of four hybrids have been distributed to farmers for production on a commercial scale.
Such diseases as ear-rot, kernel-rot and bacterial wilt in maize are important in lowering quality and causing irregularities in production. The most promising method of control appears to be the growing of disease-resistant hybrid strains resulting from the crossing of disease resistant inbred lines.
The breeding of strains of wheat resistant to leaf rust is also in progress, it having been shewn that this disease while seldom causing complete crop failure, as does stem rust, lowers the milling and baking quality of the grain, that from rusted fields being lower in protein content.
Although little has been done to improve timber trees by breeding, consideration of certain natural hybrids suggests that hybridization offers valuable prospects in this direction. Work is already in progress at the Institute of Forest Genetics, California, but there is room for more.

432. WADE, B. L. and ZAUMEYER W. J. 575:633:578.08
Modern methods of breeding for disease-resistant beans and peas.
Canning Age 1935 : **16** : 318–20.
A simple account of the procedure followed in breeding for disease resistance and in subsequent multiplication and seed production.

433. RUDORF, W. 575:633:581.143.26.03
Keimstimmung und Keimpflanzenstimmung in ihren Beziehungen zur Züchtung. (**Vernalization in its relation to breeding**).
Züchter 1935 : **7** : 193–99.
Some of the direct practical advantages of vernalization for breeding are :—(1) The flowering of early and late types together so that they may be crossed. (2) Inducing flowering for similar purposes, in plants such as short-day soya bean varieties, artichokes, etc. (3) In the crosses of winter and spring varieties the seed may be vernalized and all types induced to set seed. (4) Its use in winter cereals for testing rust resistance in the green-house before planting out. (6) The production of several generations in the year.
Other indirect advantages are :—
(1) The use of vernalization on winter cereals etc. for testing winter-hardiness. It has been found that different varieties require different exposures to cold in the grain or seedling stages before they will come into ear when sown in the spring. As a rule the varieties that require the shortest exposures to cold are also the least winter-hardy.
Vernalization of 10, 20, 30 and 40 days duration followed by the usual methods for the direct application of cold has shewn that there are varieties which come into ear when sown late in the spring but which shew also a characteristic cold resistance. The Argentine variety, Lin Calel, is an example.
(2) The effect of the treatment, and especially the effect of length of day on the physiology of tillering of winter and summer cereals. The long day of spring tends in the long-day plants to a much hastened development at the expense of tillering and growth and leads to a diminished yield. The aim should be to breed more neutral plants without completely losing their other long-day characteristics. For forage plants too this point of view needs consideration.
(3) The testing of such short-day plants as soya beans, tobacco, hemp, maize, melons, etc., with the object of discovering, if possible strains which are either neutral or even possess to a slight degree, long-day characteristics.
As the long or short-day characters as well as the cold or heat requirements in certain phases of development are genetically determined, breeding for the desired characters becomes a practical possibility.

434. 575.1:00.14
SANSOME, F. W. 576.3:00.14
Terminology of genetics and cytology.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : p. 28.
It is suggested that many of the difficulties arising from the use of an unnecessarily complicated terminology could be overcome by co-operation.

435. FELDSTEIN, M. J. and HERSH, A. H. 575.1:519
The determination of genetic constants of relative growth.
Amer. Nat. 1935 : **69** : 344–53.
The extended form of an abstract previously reviewed (Cf. " Plant Breeding Abstracts " Vol. V, Abst. 45.)

436. VIK, K. 575.1:633:576.312
Planteforedling på cytologisk basis. **(Plant breeding on the cytological basis).**
Tiddsskr. Norske Landbr. 1935 : **42** : No. 4 : 121–31 ; No. 10 : 356–59.
FLOVIK, K.
Tidsskr. Norske Landbr. 1935 : **42** : No. 9 : 303–05.

The first paper contains a detailed criticism of Flovick's article, advocating the use of cytological methods combined with genetical work in plant improvement, (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 597).
Such views are held to be unpractical and for the geneticist who is bent upon the production of superior crop plants, good results can be obtained without the aid of cytological investigation.
The second paper contains Flovik's reply in defence of his contention and a further explanation is given by Vik.

437. 575.11.061.1:635.62
SINNOTT, E. W. 575.11–181:635.62
The genetic basis of shape and size.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 117–19.

The genetic control of shape, independently of size, has been demonstrated in *Cucurbita*. In some genera a progressive change in shape occurs during development, in others it is relatively constant from the very early stages, (as in *Cucurbita* fruits).
The distribution of shape indices in F_2 progenies from crosses in *Cucurbita* involving shape differences shews marked positive skewness, but when plotted logarithmically this skewness disappears, indicating that the genes operate exponentially, i.e. 0·5, 1, 2 and 4 are separated by equal genetic intervals. Mathematical analysis of the fruit shapes also shews that they are derived from one common form by progressive exponential deformation of a single primary shape along a logarithmic gradient, by genes fixing the position of an individual on this gradient. This gradient may be considered an evolutionary gradient and shews a striking resemblance to the growth gradient found in those organs where shape changes during development.
Several primary fruit shapes have been found in *Cucurbita*, each genetically determined, and each giving rise by deformation to a series of shapes.
A similar skewness, largely disappearing under logarithmic plotting, has been found in the distribution of size in F_2 progenies, indicating that genes affect size exponentially.
It is suggested that size and shape are determined by genes affecting relationships rather than quantities. When inherited size differences are studied developmentally, they are found, unlike successive stages of growth, to form a discontinuous series each member of which has its own characteristic relationship between the extent of cell division, cell enlargement, and so on.
Arising from this hypothesis comes the idea that the genes primarily control the mechanisms for rate co-ordination, rather than the absolute rates themselves.

438. 575.113.7:575.123
FISHER, R. A. 575.113.7:576.356.5
The sheltering of lethals.
Amer. Nat. 1935 : **69** : 446–55.

By mathematical treatments it is shewn that obligatory heterozygosis such as occurs in heterostylism or sex determination by sex chromosomes does not lead to the accumulation of lethal factors in the sheltered chromosome (e.g. the *Y* chromosome) in populations with normal mutation rates.
It is also argued that the shelter afforded by the duplicate homologous or nearly homologous chromosomes in tetraploids does not lead to the accumulation of lethal or disadvantageous mutations. In general the differentiation of loci found in a tetraploid species is mainly due to evolutionary differentiation in allied specific forms, prior to the formation of a tetraploid by hybridization, and, subsequently, to favourable mutations ; regressive changes play scarcely any appreciable part.

439. 575.12:631.541
ZEBRAK, A. R. 635.656:575.257
(Grafting in genetically different lines of peas).
Trudy Moskovskoi Sel'skokhozjaistvennoi Akademii im. K.A. Timirjazeva (Trans. K.A. Timiriaseff Acad. Agric., Moscow) 1935 : **1** : 88–97.

Young shoots of the variety Yellow Victoria were grafted on to Laxton and when the grafted shoots flowered they were pollinated with pollen of Laxton. The F_1 plants so obtained were in no way different from control F_1's obtained by crossing under identical conditions but without grafting : the rounded yellow seeds of Yellow Victoria were dominant. A similar experiment was done by grafting Yellow Victoria on to Green Victoria, which it was later pollinated and again no difference was observed.

The experiment was next repeated with the variety English, having large, wrinkled seeds, short stems and intensely green leaves, and Waxy with small seeds, tall stem and yellowish green leaves. In this case the seeds obtained with Waxy as maternal parent were small and round and with English as maternal parent large and wrinkled, i.e. they resembled the maternal parent, and this was so whether the plants had been grafted or not. The colour of the leaves moreover remained unchanged by grafting and the seeds obtained by self-pollination on the grafted shoots were identical with those on the normal plants of the variety from which the shoot was taken.

The segregation of all these characters occurred on a **3 : 1** basis in the second generation and no difference was detected between the families from grafted and control plants.

It is concluded from these results that the somatic plasma exerts a selective action on the nutritive materials supplied to it by the foreign root system, the influence of which is therefore much less marked than that of many culture media and other external agencies. The results are regarded as confirming the unity of the somatic and germinal tissues as opposed to their duality in the sense of Weissman.

440. MEURMAN, O. 575.127:576.354.46
Unequal chromosomes in the bivalents of plant hybrids.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 29–31.

Cases are mentioned in a number of genera where chromosome size differences between the parents persist in the hybrid, although pairing has occurred. It is considered that the study of such phenomena might lead to important results.

441. 575.17
575.172
THONE, F. 575.173
The double function of genes.
Science 1935 : **82** : (Suppl.) p. 6.

A brief report of a discussion on notions of the function of genes in conditioning individual characters and in the organism as a whole. The embryological and biochemical aspects of gene action are also touched upon ; the reproduction of genes and their chemical action upon extra-nuclear material are illustrated ; and the possible significance of such phenomena in the ontogeny of the organism is implied.

442. 575.17:576.12
Science News.
Science 1935 : **82** : (Suppl.) p. 8.

A brief note on a survey by Professor Dobzhansky of recent discoveries about the gene, gene arrangement in the chromosome, interspecific sterility due to an alteration in the order of the genes and the role of such changes in the relative position of genes in evolution. (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 599.

443. Tschermak-Seysenegg, A. 575.172:575.12:576.311
Über hybridogene Genasthenie. **(On genasthenia due to hybridity.)**
Züchter 1935 : **7** : 187–92.
Some of the problems underlying the conception of dominance in its various degrees, complete dominance, the intermediate condition and even localized dominance are briefly indicated ; and the author's theory of genasthenia is advanced as a possible interpretation of such phenomena. This theory attributes to the genes not only their qualitative properties but also quantitative characteristics or functional valency, which may be reduced in the heterozygote or in a partly foreign plasma.
This assumption of different degrees of valency of a gene under varying internal cytological conditions, is held to be capable of providing a satisfactory interpretation of the presence and absence hypothesis, Nilsson-Ehle's theory of cumulative factors, Erich Tschermak's theory of cumulative catalytic factors, and the phenomenon referred to by Mendel as secondary segregation. The possibility of the persistence of the effect of hybridization upon gene valency is also discussed with reference to the author's work on fowl crosses in which apparent phenotypic deviations from the normal Mendelian ratios for dominants and recessives are attributed to the effects of genasthenia due to hybridization and consequent disturbance of the nucleo-plasmatic balance. In more extreme cases genasthenia may lead to genophthisis in which the gene in question is destroyed as happens to the entire nucleus in certain distant crosses such as *Solanum nigrum* x *S. luteum.*
The bearing of this phenomenon of genasthenia on the practice of breeding and on eugenics is indicated.

444. Schlösser, L.-A. 575.182:635.64
Beitrag zu einer physiologischen Theorie der plasmatischen Vererbung. **(A contribution to a physiological theory of plasmatic inheritance).**
Z. indukt. Abstamm. -u. VererbLehre **1935** : **69** : 159–92.
In order to test further the possible effect of the plasma on the gene it was necessary to find two races of plants which were alike except for their plasma and one Mendelian pair of factors.
A number of crosses made between *Lycopersicum racemigerum*, the American wild form of *L. esculentum* and various cultivated forms shewed that there existed statistically significant reciprocal differences for all the organs investigated. Among the material of the wild form two races were found which differed only by a single pair of factors determining growth in length. The reciprocal cross shewed statistically significant differences.
An examination of the osmotic pressure of the cytoplasm of the two races shewed that the taller growing race had an average osmotic value of 6 atmospheres while that of the shorter race was 8.3. The osmotic value of the F_1 of the direct and reciprocal crosses was almost exactly that of the female parent. There was no segregation in F_2 but in each case the value was that of the female parent.
The effect of the environment of the gene and the possible effect of the gene on its environment is discussed especially in relation to the problems of heterosis and mutation.

445. Navashin, M. S. 575.24:581.01
(Aging of the embryo as a cause of mutation).
Sovetskaja Botanika (Soviet Botany) 1934 : No. 6 : 27–44.
The metabolic processes in a resting seed are in many ways abnormal for the organism—at least any given organism is only adapted to remain in this condition for a certain limited length of time. The first experiment to test the effect of leaving seeds longer than this normal time in the resting state produced an unusual crop of mutants in *Crepis tectorum*. The same effect was later observed in other plants, e.g. rye. Some of these are described, including a number of abnormalities of the growing point, chromosomal irregularities, cellular inclusions, supernumerary nuclei, etc., etc., many of them recalling the anomalies commonly observed in distant hybrids or plants from X-rayed seeds. Such anomalies are found everywhere in the root cells but are less common in the shoot meristem. Though many of them are lethal, many other anomalies of a less extreme nature are described which have no adverse effect on plant growth

and cell division. The great majority of these proved to be translocations, and in many cases the new chromosome types are perpetuated from cell to cell. The most varied changes in chromosome form occur in this way, and the author thinks that conclusions of homology or relationship based on chromosome morphology may often be invalid and misleading. Conclusions as to evolutionary trends based on progressive series of chromosome numbers may be equally fallacious.

The high proportion of the mutants, occasionally reaching as much as 80 per cent, shews them to be occasioned by internal processes, since no external agency, such as natural radiation, etc., would be strong enough to produce this large proportion. The proportion moreover does not increase arithmetically from year to year as it would from an external agency but rises very much more rapidly in the later years. The rapidity of the process is also increased markedly by a rise of temperature as internal metabolic processes are. All this convinces the author that mutation is part of the natural activity of the cell, and is indissolubly associated with the life of the cell. In other words the particular organization of proteins that makes possible life contains within it the possibility also for change i.e. mutation.

The process here described is thought to have played an important part in the origin of new forms in cultivated plants, as a result of the unconscious application of conditions suitable for their occurrence, e.g. storing of seed for protracted periods or in warm sheds, disinfection with boiling water, etc.

In the discussion of the paper G. A. Nadson remarked that older tissues and organisms, including micro-organisms, were frequently more subject to mutation, and the effect of radiation and other agencies might well be that it accelerates aging of the tissue. Pieces of heavy metals placed in the close vicinity of, though not in contact with, micro-organisms have often been found to cause mutations, apparently acting as secondary centres of radiation as a result of their bombardment y natural rays.

A. N. Ljubimenko considered that the term aging could not be applied to a resting seed and that further knowledge was necessary on the precise condition of the protoplasm in such resting seeds.

B. A. Keller doubted the value of the mutations observed by Navashin in evolution, being mainly harmful recombinations of existing genes.

In replying, M. S. Navashin stated that gene mutations do apparently occur in the material side by side with the chromosome mutations. Experiments to test this conclusively on pure line material of wheat and barley are in progress. He also pointed out that homozygous translocations, resulting in sterility with the parental form, constitute a highly important evolutionary step. Other mutants have closed flowers or a different time of maturity, preventing them from crossing with the normal form.

446. 575.242:575.115:576.12
633.71:575.115

East, E. M.

Genetic reactions in *Nicotiana*. III. Dominance.

Genetics 1935 : **20** : 443–51.

Based largely on his experience of genetical work in *Nicotiana* the author advances certain views on dominance which he believes to have a bearing on organic evolution in general.

The majority of mutations detected in the genetical laboratory are recessive because they are defective in nature ; i.e. the mutant gene is unable to carry out its function as efficiently as the wild type or normal gene. It is not this type of mutation which serves as material in evolution, but the small, non-defective mutations, quantitative rather than qualitative in action. The latter make up the bulk of the differences between species, are responsible for the " patterns " characteristic of given species, and as is shewn in species hybrids, operate without dominance, being constructive rather than destructive. There is evidence that these non-defective mutations are much more frequent in nature than the more familiar defective mutations, but are more difficult to detect.

It follows from the above that the deviations forming the fundamental material of evolution are the small variations of Darwin and so we return to Darwin's views, modified by the idea of Mendelian inheritance.

447. 575.257
WINKLER, H. 575.255
Chimären und Burdonen. Die Lösung des Pfropfbastardproblems. (**Chimaeras and Burdos. The solution of the graft-hybrid problem.**)
Biologe 1935 : **4** : 279–90.

A general survey of the topic.

Ruling out the possibility of one partner in a graft affecting the characters of the other so as to make is intermediate between the two, there remain two possible modes of origin of graft hybrids, chimaera formation and " burdo " formation (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 1019).

Chimaeras are strictly defined as organisms in which genotypically different cells make up, without cell fusion, a single individual ; they may be sectorial or periclinal. The form of periclinal chimaeras depends on the position and extent of the tissue of each partner at the growing point and hence in the whole plant ; many different types may be produced depending on which layers are affected, and the extent to which those layers control the growth of the organs of the plant. The author points out that the epidermis can modify the form of the leaf—the views of Krenke (Cf. " Plant Breeding Abstracts," Vol. IV, p. 253) being severely criticised in this connexion—while on the other hand the third layer of cells in the growing point often has some influence, as well as the hypodermis, on the inner tissue of the leaf. The different types of periclinal chimaeras are described, and their tendency to revert to one or the other of the partners is explained.

Microspore development is usually normal in periclinal chimaeras, being the same as in the parent to which the hypodermis belongs, but megasporogenesis is often accompanied by irregularities, resulting in reduced fertility.

One of the author's early graft-hybrids, *Solanum Darwinianum* was believed to be a " burdo," i.e. resulting from the fusion of two somatic cells of different species, but this was never decided owing to the death of the plant. More recently however (Cf. " Plant Breeding Abstracts," *loc. cit.*) two chimaeras Burdo X and Burdo Ch were produced in which the epidermis had arisen from cell fusion. Efforts are now being directed towards producing from these plants, chimaeras in which the hypodermis is of a " burdo " nature, with a view to studying their sexually produced progeny. The production of the two burdos mentioned is of theoretical interest as shewing that " fertilization " is possible with somatic as well as with germ cells, though the two processes differ in that fusion of two somatic cells is not necessarily followed by development of a zygote, the capacity to produce adventitious shoots being a necessary condition.

Incidentally, it was in the course of the author's efforts to produce a burdo that the method, afterwards developed by Jørgensen, of producing tetraploid tomatoes was discovered.

448. ZIRKLE, C. 575.31:575.4
The inheritance of acquired characters and the provisional hypothesis of Pangenesis.
Amer. Nat. 1935 : **69** : 417–45.

A review of the literature on these topics from the Greeks to Charles Darwin. It is pointed out that Lamarck had many predecessors who believed in the inheritance of acquired characters and that the essentials of Darwin's theory of Pangenesis had been laid down by many writers from Hippocrates onwards. The two ideas often ran together, pangenesis in one form or another being given as the explanation of the inheritance of acquired characters, as it was by Darwin.

EVOLUTION 576.12

449. WRIGHT, S. 576.12
The emergence of novelty. A review of Lloyd Morgan's " emergent " theory of evolution.
J. Hered. 1935 : **26** : 369–73.

An examination of the philosophical principles of Lloyd Morgan's hypothesis of emergent evolution. It is considered that the emergent hypothesis is not a scientific hypothesis, but rather

an expression of a probable limitation of the possibility of complete scientific treatment, a sort of non-quantitative principle of indeterminacy.
The term emergent is considered applicable only to primary novelty, i.e. to the first occurrence of a phenomenon and not to the recurrent properties of systems, however unaccountable these may be from the properties of the components, in the present state of science.
In its application to organic evolution the term emergent it is suggested might be used as a contrast to orthogenetic.

ORIGIN OF SPECIES, ETC. 576.16

450. TURRILL, W. B. 576.16:575
Some aspects of experimental taxonomy.
Proc. 6th. Int. Bot. Congr. Amsterdam 1935 : **2** : 57–58.
Some of the ways in which genetics can assist taxonomy are mentioned, e.g. constant breeding hybrids, intraspecific heterozygosity, the synthesis of existing species, the limits of crossability, and so on.

451. MÜNTZING, A. 576.16:575:576.3
The species concept in the light of modern research.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 56–57.
By the use of genetics, cytology and ecology in taxonomy in addition to the traditional criteria of morphology and geographical distribution, a field of work has been opened up which may be termed experimental taxonomy.
The author discusses the significance of the terms ecotype, ecospecies and coenospecies in the light of recent cytogenetic findings.
In many species it has been demonstrated that there are races which differ ecologically, shew incompatibility or sterility when crossed, which moreover, often appear to be an autopolyploid series. Such races, the author suggests may be classified as ecospecies, and this evidence, together with that derived from experimentally produced autopolyploids throws light on the evolutionary value of autopolyploidy.
The distinction between ecotype and ecospecies is not sharp, while at the other end of the scale, the unit called a coenospecies is not easy to understand and it appears that in some cases it may include ecospecies from more than one genus.

CYTOLOGY 576.3

452. WRINCH, D. M. 576.312.32:577.1
Chromosomes and molecular aggregates.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 24–26.
A further account of the author's hypothesis (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 538) which explains the genetical specificity of a chromosome in terms of the side chains of the amino acid residues which are linked up to form the protein molecules of which the chromosome is considered to be composed.
Nucleic acid molecules will be found in highest concentrations where there is a preponderance of basic residues, and such regions will form the " dark bands " found in the chromosomes from the salivary glands of insects.
It is estimated according to this hypothesis that a gene may be associated with a length as small as 3.5 Å, which is considerably smaller than the present lowest estimate of 100 Å.

453. LA COUR, L. 576.312.32:578.6
Technic for studying chromosome structure.
Stain Tech. 1935 : **10** : 57–60.
Various techniques for demonstrating the spiral structure of chromosomes are described, involving treatment of pollen mother cell smears with fumes of ammonia, nitric acid, hydrochloric acid, acetic acid or boiling water respectively, before fixation.

454. BACKMAN, E. 576.312.35:578.65
A rapid combined fixing and staining method for plant chromosome counts.
Stain Tech. 1935 : **10** : 83–86.
In the combined staining and fixing solution used anthraquinone is substituted for picric acid in Bouin's formula and alizarin red S is added with a metallic salt as a mordant. The maximum time required for the whole process of staining and fixing is 8 hours.
The technique was successful with anther smears and also with root tips of *Allium*, *Secale*, *Hordeum*, *Yucca*, *Phaseolus*, *Nicotiana*, etc.

455. KOSTOFF, D. 576.312.36:578.088.2:633.71
Chromosome alterations by centrifuging. (A preliminary report).
Z. indukt. Abstamm.-u. VererbLehre 1935 : **69** : 301–02.
Germinating seeds of various plants were centrifuged, the most effective results being obtained from seeds of *Nicotiana Langsdorffii* centrifuged for 2 hours with four interruptions of 4 minutes. The machine made 1,500 rotations per minute and had a radius of 130mm. As a result, chromosomal chimaeras were produced, involving fragmentation, increases in chromosome number and chromosome doubling.

456. SCHIEMANN, E. 576.32:633
Der Chromosomenbestand der Kulturpflanzen. (**The chromosome condition in cultivated plants.**)
Züchter 1935 : **7** : 249–54.
Four types of chromosome condition are distinguished, the *Chrysanthemum*, the *Antirrhinum*, the *Pinus* and the *Carex* types and examples of each type are found among cultivated plants.
The increase in chromosome number though of no absolute value may have a relative importance, as in the polyploid series.
A knowledge of the underlying principles is essential to the plant-breeder in making the best use of cultivated plants.

457. AKEMINE, T. 576.354.46
[On the heritable asynapsis in plants (Collective review).]
Jap. J. Genet. 1935 : **11** : 199–204.
A general survey of past work on the subject, referring to the investigations of Bergner, Blakeslee and Beadle, Kostoff and others. The external and internal causes of asynapsis are first dealt with ; then follows an account of the reduction divisions in pollen and embryo-sac mother cells, the formation of chiasmata and crossing-over.

458. DARLINGTON, C. D. 576.354.46:575.116.1:576.312.32
Crossing over and the internal mechanics of the chromosomes.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 26–28.
A concise account of the author's explanation of crossing-over (Cf. " Plant Breeding Abstracts," 319.)

459. LAWRENCE, W. J. C. 576.356.5
The secondary association of chromosomes.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 28–29.
Secondary association arising at pro-metaphase I and II is due to the general affinity between chromosomes having some homology, occurs only in polyploids and is useful in demonstrating phylogenetical relationships between small chromosomes which are difficult to identify on account of their small size.
It consists in the differential approximation of bivalent chromosomes at metaphase I or of univalent chromosomes at metaphase II and is absent at diakinesis.

460. TISCHLER, G. 576.356.5:581.9
Die Bedeutung der Polyploidie für pflanzengeographische Probleme. (**The significance of polyploidy for problems of plant geography**).
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 54–56.
Some of the views already expressed in the more extensive study reviewed in " Plant Breeding Abstracts," Vol. V, Abst. 4.

SEX 577.8

461. SCHAFFNER, J. H. 577.841:577.88
Observations and experiments on sex in plants.
Bull. Torrey Bot. Cl. 1935 : **62** : 387–401.
From his observations on the alteration of the expression of sex in diœcious and monœcious plants by ecological influences, the author lays down the hypothesis that the sex condition of an individual plant is determined, not by Mendelian sex genes, but by a physiological balance produced by the interaction of the general hereditary potentialities of the cell on the one hand and the environmental conditions on the other. He denies that there are sex-determining chromosomes, since the sex of the gametophyte is independent of its chromosome complex. Subsequent to the evolution of the diœcious condition, allosomes may make their appearance, and may contain physiological factors influencing the physiological balance in the egg at the time of fertilization and causing it to swing either to male or to female, but the balance is also affected by ecological conditions and may quite well be reversed by them.

BOTANY 58

462. CLELAND, R. E. 58.007:575.24
Hugo de Vries, 1848–1935.
J. Hered. 1935 : **26** : 289–98.
A brief account of the life of H. de Vries and his work in plant physiology, genetics and evolution.

463. HUDSON, P. S. 581.143.26.03
Vernalization, Lysenko's yarovization of seed.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 20–21.
An account of the underlying principles of vernalization.

464. JANNACCONE, A. 581.143.26.03
La "jarovizzazione" delle colture nella teoria e nella practica. (**The vernalization of cultivated plants in theory and in practice**).
Ann. Tec. Agr. Roma 1935 : **8** : 216–25, 270–84.
The continuation and end of the paper (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 923) gives practical details of Lysenko's methods, reviews the results of workers in other countries who have made use of vernalization and discusses its possible importance for Italian agriculture.

465. VASCONCELLOS, J. DE CARVALHO E 581.143.26.03
Algumas considerações sôbre os fundamentos cientificos da vernalisação ou iarovisação. (**Certain considerations on the scientific foundations of vernalization or jarovization**).
Rev. Agron. Lisboa 1934 : **22** : No. 2 : Pp. 14.
The author traces the processes which occur at the time of vernalization, emphasizing the biochemical aspect, on the basis of which he concludes that although the process of germination is retarded by the treatment, the hydrolysis of carbohydrates to sugars proceeds rapidly. This is regarded as one of the probable causes of the greater activity of the plants arising from the vernalized seeds, together with the changed colloidal properties of the protoplasm also brought about by the low temperature.

466. Ivanišin, I. A. 581.143.26.03:633.51
(Vernalization of cotton in new cotton regions).
Bor'ba za Khopok (Cotton Campaign) 1934 : No. 10–11 : 115–24.

The first stage in cotton vernalization is to moisten the seed to 80 per cent (57 litres water to 100 kg. cotton seed). The moistened seed is left in a heap, whereby the temperature in the heap rises to 23–35°C., under which conditions the seed is maintained for 15–20 days ; every means, including drying, cooling, etc., is used to prevent the seeds germinating and to avoid the growth of moulds. Not more than 1–3 per cent of seeds must be allowed to germinate. After this treatment the seeds are sown in the ordinary way.

The results of the experiments of the three years 1932, 1933 and 1934 shew that after vernalization all the main developmental stages are accelerated ; thus germination is accelerated by 2 to 14 days, flowering by 3 to 8 days and maturity by 4 to 15 days as a result of which the yield and especially the production of lint is considerably increased. On May 2nd 1933 the vernalized seedlings sown on April 20th were more advanced than unvernalized seedlings sown both on April 20th and April 10th. Yield differences of 2–3 centners per ha. in favour of the vernalized plants were also obtained in 1933.

Plots of 1 ha. in area were sown with vernalized and unvernalized seed in 1933 and 1934. In 1933, 44 per cent of the vernalized and only 19 per cent of the unvernalized plants had matured on October 9th and in the following year the date of maturity was September 9th for the vernalized and September 13th for the unvernalized, the yields in the two years being 11·1 and 8·2 centners per ha. respectively for the vernalized and 8·8 and 6·0 for the unvernalized. The effect was greater in 1933 which was a most unfavourable year for cotton in these new regions, whilst in 1934 the conditions were more favourable for natural vernalization.

Large-scale vernalized sowings on collective farms were made in 1932 on an area of 600 ha., this area being increased to 2,000 ha, in 1933 and 3,000 in 1934, control sowings being made in each case. The average increase in yield was from 0·3 to 2·5 centner per ha. and on one farm the vernalized sowings gave four times as much yield per ha. as the control. In most farms the vernalized seeds germinated more rapidly and flowering was in most cases similarly accelerated. Not infrequent cases of failure in cotton vernalization are partly attributed to inadequate attention to the details of technique.

467. Savage, D. A. 581.162.3:578.08
A field aspirator for emasculating sweet clover flowers.
J. Amer. Soc. Agron. 1935 : **27** : 774–75.

A method of utilizing the suction in the intake manifold of a car for emasculating clover flowers, the intake being connected *via* a 2,000 c.c. flask to a hypodermic needle. The technique may have its application to other small flowers.

468. 581.163:578.08
Chiarugi, A. 575.143:581.163
La partenogenesi sperimentale nelle piante superiori e la sua importanza per le indagini sulla loro constituzione genetica. **(Artificial parthenogenesis in the higher plants and its importance for the study of their genetical constitution).**
Boll. Soc. Ital. Biol. Sper. 1934 : **9** : 1182–1207.

The author defines the phenomena of diploid and haploid parthenogenesis and presents a detailed review of the cases of the latter observed recently in flowering plants, attention being given first of all to their mode of origin. The most successful method of inducing haploid parthenogenesis is pollination with a genetically distant species capable of inducing parthenocarpy but not of fertilization. It is not infrequently also induced by pollen which, though capable of fertilization, does not for some reason effect it, thus even occasionally in intervarietal crosses within the same species. In these latter cases, an essential factor is that the cross should be effected at a low temperature and by this means parthenogenesis can be induced even in self-pollinations as in *Datura ferox* by Belling in 1923. This results from the failure of the pollen tubes to reach the ovary, which thus suggests another method, namely pollination with an insufficiency of pollen or other methods of dissociating the stimulation of the development of the ovary from

the fertilization of the ovule which usually accompanies it. Thus the periclinal chimaera of *Solanum nigrum* var. *gracile* and *S. sisymbrifolium*, where the pollen tube of the one species and the stigmatic epidermis of the other are evidently incompatible, gives a number of haploids on selfing, although the actual gametes are of the same species. Stimulation of the ovary walls with fine needles will sometimes induce parthenogenesis, and it is probable that many other agencies could have the same effect.

The theoretical importance of androgenous haploids, which originate from the paternal nucleus without its cytoplasm and yet are identical with the male parent, is mentioned.

The conclusion is reached that haploid parthenogenesis is not uncommon in nature though the greater debility of the haploids leads them to perish except in particular cases.

The characteristics of the morphology of haploids are discussed, followed by their chromosomal behaviour, which can be summed up by comparing it with that of sterile hybrids. This resemblance extends to the tendency to chromosome duplication with the formation of a fertile plant, in this case homozygous in all its characters. These latter are in fact usually obtained in greater proportion than the haploids and the method constitutes a valuable means of producing perfect homozygotes.

The importance of the haploids in shedding light on the chromosomal constitution of the species, by the presence or absence of pairing etc., is pointed out.

A table is given of the cases known of haploid parthenogenesis in diploid, tetraploid and polyploid species and of cases of androgenous parthenogenesis.

469. WARMKE, H. E. 581.43:578.65:576.312.35

A permanent root tip smear method.

Stain Tech. 1935 : **10** : 101–03.

Devised for the study of chromosome number and morphology in *Trillium* in which the chromosomes are particularly large this technique has also been used for *Allium* and other genera.

Its advantages are its rapidity and permanence, possibility of flattening the figures so that the chromosomes lie in one plane. The percentage of good preparations was high.

470. *ALEXEYEV, B. P. 581.9(51)

[Plant resources of China. (Fruits, vegetables, industrial crops and ornamental plants).]

Suppl. 72 Bull. Appl. Bot. Leningrad 1935 : Pp. 108.

The history of the botanical study of China by European botanists is traced in some detail, from Marco Polo up to the expeditions of the last few years sent by the United States Department of Agriculture. The flora is characterized by its great wealth of species and forms and their extreme localization. No natural barriers are present between the tropical and temperate belts, the result being that the two have intermingled, leading to the evolution of a flora of a richness and variety unparalleled in any other part of the northern hemisphere. This zone, comprising the mountains of western China, Indo-China and the eastern Himalayas, is regarded as the centre of origin of the flora of the whole of eastern Asia including the entire cultivated flora of the east, and thus ranks as one of the most important world centres of origin of agricultural plants. The mountain sides abound with dozens and hundreds of species and varieties of *Malus*, *Pyrus*, *Cydonia*, *Chaenomeles*, *Docynia*, *Mespilus*, *Eriobotrya*, *Cotoneaster*, *Crataegus*, *Sorbus*, *Photinia*, *Osteomeles* and *Prunus*, and also *Rubus*, of which dozens of species are present, some of them with excellent fruit quality, though not known in Europe. The same is true of the *Vitaceae* and some of the vine species are equal to the American species in resistance to phylloxera and some also markedly resistant to cold.

There are also eight genera of the *Saxifragaceae*, including several dozen species of *Ribes*, one of which, *R. longeracemosum*, has fruit bunches up to 30 cm. in length.

There is a great variety of forms of *Ziziphus*, both cultivated and wild and a number of peculiar forms of nuts unknown elsewhere, as *Torreya*, *Castanopsis*, *Pasania* and an endermic species of *Carya*.

The same position is observed in the subtropical fruits ; 9 genera of the sub-family *Rutaceae* of the *Aurantiae* occur, including 3–4 wild species of *Citrus* or probably more, in addition to a

* An abridged translation of this bulletin is on file at the Bureau.

tremendous variety of cultivated *Citrus* ; 10 species of *Diospyros*, including 3 cultivated ones, and a great variety of *Eryobotrya japonica*. The genera *Myrica* and *Rhodomyrtus* are endemic. Many interesting tropical fruits also occur, e.g. *Litchi sinensis*, *Nephelium longan*, *Musa Cavendishii*, etc., etc.

The introduction of these new forms into breeding, especially in breeding for resistance, promises a new field of possibilities. The Chinese forms are in general characterized by their immunity to disease. The most cold-resistant forms of apricot and peach are found in the mountains of north China and Manchuria and also the most resistant vine, *Vitis amurensis*. The Chinese subtropics experience lower temperatures than any other such regions and are thus the most promising source of cold-resistant forms capable of growing in other subtropics with a continental climate, such as the Soviet subtropics. In this respect the wild *Citrus* are mentioned with special interest, including *Citrus junos*, *C. ichangensis*, *Poncirus trifoliata* and *Fortunella*. The Chinese fruits are also characterized by their extremely wide range in time of maturity and include both excessively late and excessively early forms. They vary equally widely in respect of size, form, colour, flavour, yield, etc., and afford a rich store of genes for all these characters and many more, though breeders have up to the present not even begun to make use of it.

A full survey is made of the existing information, largely collected from the literature, on all the Chinese genera of fruit trees from the standpoint of specific and varietal diversity, distribution and presence of useful economic forms. Besides the forms already referred to, special mention is given to the pear Yahr-Li, combining the pear quality with the quince flavour, *Malus baccata* and *M. prunifolia*, the most frost-resistant apple species known, high quality forms of *Crataegus pinnatifida* used for fruit and surpassing both apple and pear in drought resistance, extremely aromatic Chinese quinces, *Chaenomeles*, forms of *Ziziphus vulgaris* highly resistant to cold and drought, a variety of forms of *Actinidia* suitable for breeding, *Citrus junos* said to be equal to *Poncirus trifoliata* in frost-resistance and superior to it in the possession of edible fruits, dwarf bananas apparently resistant to frost and many endemic mulberries ; also frost-resistant forms of *Juglans sinensis* in quality equal to *J. regia*, and other Chinese walnuts resistant to drought and diseases, high-quality chestnuts, *Castanea mollissima*, resistant to cold, drought and a number of fungous diseases, including chestnut blight, *Endothria parasitica*, and regarded as much more promising for Soviet breeding than the true chestnut. Three very frost-resistant species of tea occur in the mountains, namely *Thea microphylla*, *Th. trichoclada* and *Th. drupifera*. *Th. sinensis* is also found wild at altitudes up to 2,000 m. Tea exists in great variety in mountain forests yet unexplored. Several endemic species are already known and an expedition to this region would possibly have the same far reaching results for tea as the expeditions to South America have had for the potato. The Chinese cinnamon, *Cinnamomum cassia*, has been found resistant to −6°C. and it is hoped to find still more cold-resistant forms. China contains the centres of origin of the mulberry, tung oil, bamboo and many other such plants.

A list is given of the species of fruit trees and their wild relatives found in China, with an indication of those having edible fruits, those which are adventive, the regions in which they are found and whether wild, cultivated or both. The species are arranged according to families and several varieties of some species are included. Similar lists are given for the main technically valuable trees and for ornamental forms.

China is also the centre of origin of a number of important vegetables, expecially *Cruciferae* ; thus in *Brassica* no less than 13 of the 17 known species are present, 8 of these being endemic and the other 5 have a great many endemic Chinese varieties. They have been very little studied and it is probable that further investigations will reveal a number of other new species and varieties. The same is true of a number of other vegetables, including the soya bean ; and even the adventive vegetables, including those of comparatively recent introduction, have produced a number of peculiar, endemic recessive forms quite unknown in the primary centres of their development, e.g., the waxy forms of maize and *Phaseolus* and many unusual rices. This points to some peculiarity of the ecological conditions of the country which apparently favours this process of form production. Even these crops are therefore worthy of investigation, as many of the recessive forms found are of decided value from a practical standpoint.

The conclusions based on this survey are outlined, indicating the richest areas with respect to the different crops considered.

FIELD TESTS 631.421

471. 631.421:519.24
FRANKENA, H. J. 63.0014(49.2)
Over blanco—of blinde proeven. (**On blank tests.**)
Versl. RijkslandbProefst. 's-Grav. 1935 : No. 41. A : 173–209.

The data of 15 uniformity trials, on grain, potatoes and grasses, were used for the study of field experimental errors. By aggregating the unit plots (5 × 5m.) in various ways it was found that the arrangement and form of component plots did not affect the size of the error. Error was reduced, however, as the size of plot was increased. For a given area many small plots are advocated rather than few large ones, if the area is to be limited in size without adverse effect upon the error. There appeared to be no sign of regular fertility relationships ; in consequence it was hardly necessary to consider special methods of calculation which take this factor into account. The technique employed appeared to result in satisfactorily low errors, conditions evidently being favourable ; standard errors of the order of 5–6 per cent might be expected on the average. Various methods of calculation, such as those of " Student," Harris and Fisher, were tested on the data, and a final recommendation is that the " analysis of variance " method of Fisher could with advantage be more extensively employed. J. W.

PLANT DISEASES 632

472. MÜLLER, K. O. 632.411.4:576.16:633.491
Die Variabilität der Virulenz und der biologischen Spezialisation bei *Phytophthora infestans*. (**Variability in virulence and biological specialization in *P. infestans*).**
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 188–90.

The recent discovery of the *S* race of *P. infestans* and the possibility of breeding resistant potatoes from *Solanum demissum* varieties are mentioned.
Lamarckian adaptation is rejected as an explanation of the origin of the *S* race and the true explanation of its apparently sudden origin is held to be a purely selective action on the part of the *W*-varieties—the only assumptions involved in this view being either that all along the *S* race has existed, sparsely distributed, over middle Europe or that the *A* race, regardless of whether it encounters the *W* varieties, has the tendency to pass from the *A* to the *S* condition.
Mention is also made of race *T*, specially virulent on the tomato, and of the possibility of a fourth form isolated from potatoes which is distinct from *S*, *T*, and *A* (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 620).

473. ULLSTRUP, A. J. 632.42:576.16:575.247:633.15
Studies on the variability of pathogenicity and cultural characters of *Gibberella saubinetii*.
J. Agric. Res. 1935 : **51** : 145–62.

From material of *Gibberella saubinetii* (Mont.) Sacc. collected from different localities cultures were made derived from either a single ascospore or from a single hyphal tip from an ascospore germ tube. All cultures so derived were alike at first, but in subcultures derived from single conidia, variant forms appeared which remained constant during further subculture.
The pathogenicity of certain of these variant forms was studied in relation to maize seedlings, and it was found that there was a marked correlation between rapidity of radial growth and abundance of aerial mycelium in culture on the one hand and pathogenicity on the other. No correlation was observed between abundance of conidia and pathogenicity. Passage through the host had no apparent effect on the cultural characteristics of strains. No difference was observed in the relative pathogenicity of the strains to two lines of maize, one resistant and one susceptible, all forms being more virulent in the susceptible strain.
The nature of cultural variability in isolates of fungi is discussed, and it is suggested that the variability found in the present investigation may be due either to anomalies of nuclear division or to true mutation. That the variant forms do not occur in the isolations made from diseased plants may be due to their being weak pathogens ; in nature if they exist at all it is probably as saprophytes.

474. SCHMIDT, M. 632.42 *Venturia inaequalis* : 576.16:634.11
Venturia inaequalis (Cooke) Aderhold. IV. Weitere Beiträge zur Rassenfrage beim Erreger des Apfelschorfes. [*V. inaequalis* (Cooke) **Aderhold. IV. Further contributions on the question of races in the pathogen of apple scab.**]
Gartenbauwiss. 1935 : **9** : 364–89.

Further evidence is presented (Cf. " Plant Breeding Abstracts " Vol. V, Abst. 1108 and Vol. VI, Abst. 109) of the numerous morphological differences in monosporidial cultures of *V. inaequalis* isolated from various hosts. The typical formations were shewn not to be due to any influence by the different hosts. A study of polymorphism in the populations of the fungus living on three hosts (two common apples and one *Malus baccata*) shewed that the 289 monosporidial cultures isolated comprised 111 different types, each of which was found on only one of the three hosts. Mutation and subsequent inter-hybridization are discussed as potential causes of the great diversity of forms found which may, it is suggested, represent individual races of the fungus. A hybridization technique is being evolved as a preliminary to a decisive test of the genetic or non-genetic nature of the differences observed.
The possible bearing of the above observations and the ultimate findings regarding physiological specialization to certain definite hosts upon the breeding of scab resistant apples are considered.

475. DÉFAGO, G. 632.42:576.16:634.2
Sur l'existence de formes biologiques au sein du genre *Leucostoma* (Nits.) v. Höhnel. [**On the existence of biological forms in the genus *Leucostoma* (Nits.) v. Höhnel.**]
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 192–93.

Among the stocks of *Leucostoma Persoonii* (Nits.) Togashi obtained from different *Prunus* species in Switzerland nine types can be distinguished differing in certain morphological characters and in their behaviour on culture. This variation, which in the Swiss forms does not extend to the conidia, asci or ascospores, makes it difficult to distinguish *L. Persoonii* from *L. nivea* except by artificial infection experiments.
The forms differ somewhat in virulence, but are not specific in respect of the hosts they attack ; infection can be transmitted from one *Prunus* species to another.
Other forms can also be distinguished in *L. Persoonii* coming from other countries and also in *L. cincta* and *L. nivea*.
It is considered that these constitute physiological forms, but less specialized than those found in the Uredinales.

476. STAKMAN, E. C. 632.451:576.16:575.1:633.1
Physiologic specialization in cereal smuts.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 187–88.

Physiological specialization has been demonstrated in most of the cereal smuts, though the conception of physiological forms varies according to the method used for distinguishing them.
Hybridization between different smut species and even between genera has been demonstrated several times, and there is no doubt that it occurs within species, being probably responsible for a good deal of variation in pathogenicity.
The practical importance, however, of hybridization and of mutation is not yet sufficiently known. It appears that some smuts are relatively stable, while others vary greatly by hybridization and mutation.

477. STRAIB, W. 632.452 *P. glumarum* : 576.16:633.1
Infektionsversuche mit biologischen Rassen des Gelbrostes auf Gräsern. (**Infection experiments with biological races of yellow rust on grasses.**)
Arb. biol. Reich. Land-u. Forstw. Berl. 1935 : **21** : 483–97.

The infection reactions of 227 species of grasses afforded no justification for retaining Eriksson's *formae speciales tritici* and *hordei* of yellow rust races.

478. STRAIB, W. 632.452 *P. glumarum* : 576.16:633.1(43)
Auftreten und Verbreitung biologischer Rassen des Gelbrostes (*Puccinia glumarum* [Schm.] Erikss. et Henn.) im Jahre 1934. [**Occurrence and distribution of biological races of yellow rust (*P. glumarum* [Schm.] Erikss. et Henn.) in the year 1934.**]
Arb. biol. Reich. Land-u. Forstw. Berl. 1935 : **21** : 455–66.
From seventy-four localities in Germany and other countries 114 collections of yellow rust were made, 110 being taken from wheat and 4 from barley. From these 114 populations 169 monosporidial strains were isolated, tested and found to contain 14 biological races including numbers **23, 24** and **25** which are new.
Forms 23 and 24 were used in a comparative test of the virulence of "barley" yellow rust races and the "wheat" yellow rust races, on wheat, barley and wild grasses. The results are held to shew that Eriksson's assumption of the existence of *formae speciales* in *P. glumarum* is no longer tenable—more especially since races were found which were similarly weak in virulence on both wheat and barley and could not therefore be classed as either a special barley or a special wheat form.
The distribution and frequency of the various forms in 1934 are discussed. The prevalence of race 7 in Germany is attributed to the cultivation of wheat lacking summer resistance to this race. The drought of 1934 has shewn clearly the selective action of such wheats as regards the yellow rust races found in Germany (Cf. "Plant Breeding Abstracts" Vol. V, Abst. 298).

479. 632.484 *Fusarium niveum* : 576.16:635.615
SLEETH, B. 635.615–2.484–1.521.6
***Fusarium niveum*, the cause of watermelon wilt.**
Bull. W. Va. Agric. Exp. Sta. 1934 : No. 257 : Pp. 23.
Pathogenic and cultural tests with 23 isolates of *F. niveum* on seedlings of a number of varieties of water melons demonstrated the existence of physiological specialization in the fungus. The strains differed in virulence and seedlings from varieties bred and selected for wilt resistance were better able to withstand the effects of inoculation.
The question of dissociation as a cause of new strains is emphasized. In testing the resistance of a variety many strains of the pathogen should be used.

ECONOMIC PLANTS 633

480. 633:576.16:575
Origin of cultivated plants.
Philipp. Agric. 1935 : **24** : 177–79.
Extracted from the Proceedings of the Association of Economic Biologists, Coimbatore 1930–33. (Cf. "Plant Breeding Abstracts," Vol. V, Abst. 549).

481. GHIMPU, V. 633:576.312.32
L'importance des recherches chromosomiques dans la culture et la sélection des plantes. (**The importance of chromosome research in the cultivation and breeding of plants.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial Roumanie. Sect. IV : Thème No. 2 : Pp. 5.
It is suggested that chromosome studies are useful in the identification of plants, especially of seeds, when morphological distinctions are not clear ; in hybridization, to indicate which crosses are likely to fail, and in studying the plant relationships and evolutionary problems in general.

482. TODARO, F. 633–1.557:575
A propos de la contribution des plantes sélectionnées à l'accroissement de la production agricole. (**On the contribution of improved plants to the increase of agricultural production.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial (Extrait) Italie. Sect. IV : Thème No. 2 : Pp. 6.
After outlining the general method of obtaining an improved race of plants by selection, or hybridization and selection, the author points out that the value of a variety can only be expressed in relation to the conditions under which it is grown.
The question of the distribution of seeds is also considered.

483. KESSLER, W. 633–2.111–1.521.6:581.1
Über die inneren Ursachen der Kälteresistenz der Pflanzen. (**On the internal causes of cold resistance of plants**).
Planta 1935 : **24** : 312–52.
From experiments with *Saxifraga cordifolia*, *Hedera helix* and *Sempervivum glaucum* it is concluded that no direct causal relationship exists between resistance and osmotic pressure and H ion concentration of the cell sap. Resistance is apparently closely related to winter dormancy which in its turn depends upon changes in the plasma due, it is thought, to greater viscosity following increased hydration of the plasma colloids. Increased hydration of the micellae should imply greater cold resistance since a lower temperature will be required to dehydrate them to such a degree that at the onset of thawing they cannot re-absorb water rapidly enough.

484. RICE, M. A. 633–2.4:576.16:631.521.6
The cytology of host-parasite relations.
Bot. Rev. 1935 : **1** : 327–54.
In this survey brief reference is made to the various theories concerning the nature of plant resistance to fungous parasites. Specialization of the parasite with definite host reactions for the different forms has actually proved an aid in breeding for resistant forms of plants, and where such definite and characteristic reactions of the hosts to the various pathogens and their forms are lacking (e.g. *Ophiobolus*, *Fusarium*, etc.) breeding for resistance is more difficult.

CEREALS 633.1

485. WAHLEN, F. T. 633.1:575(49.4)
Möglichkeiten der Förderung des Getreidebaues in der Schweiz. Bericht an die Gesellschaft Schweizerischer Landwirte, erstattet im Auftrage einer Kommission. (**Possibilities of promoting cereal cultivation in Switzerland. Commission Report to the Society of Swiss Agriculturalists**).
Schweiz. landw. Mh. 1935 : **13**(3) : Pp. 39.
The quality of Swiss varieties of wheat derived from improved land wheats is very high and any further advances can only be attained by improving other features such as resistance to disease or lodging, etc. by crossing the Swiss with foreign types superior in these characteristics though inferior to the Swiss forms in quality. Systematic progeny tests for quality, variety tests and cooperation between the agricultural research institutions, the organizations for seed raising, seed control, etc. are all recommended as tending towards the promotion of cereal culture.

486. GAERTNER, T. VON and 633.1:581.143.26.035.1
BRAUNROTH, E. 635.655:581.143.26.035.1
Über den Einfluss des Mondlichtes auf den Blühtermin der Lang-und Kurztagspflanzen. (**On the effect of moonlight on the time of flowering of long and short day plants.**)
Beih. bot. Zbl. 1935 : **53** : 554–63.
In the summer of 1934 one hundred specimens each of various long and short day plants were grown in pots so that 50 per cent of each lot of plants were exposed to moonlight while the other

50 per cent were in darkness. During the day the pots were kept in an open sunny field, at night they were put in a greenhouse with all glass sides, kept on the field. Half of the house could be darkened by dark cloths at any time. The night temperatures were approximately the same in both halves of the building, with the exception of a few days.
In the four long-day plants—*Hordeum distichum nutans*, *Triticum vulgare*, *Iberis amara* and *Agrostemma Githago*—the time elapsing before flowering was shortened by a few days under the action of moonlight ; whilst in the short-day plants *Soja hispida* and *Pharbitis hispida* the onset of flowering was delayed by moonlight, and a similar effect was found in *Panicum miliaceum* though a certain apparently anomalous behaviour was noted in one series of tests. *Amarantus retroflexus* gave mutually conflicting results.
In general it may be concluded that moonlight has a similar effect to daylight on long and short day plants. Judging by the estimated average amount of moonlight for the months of the test apparently very small degrees of intensity of light are sufficient to elicit the photoperiodic response. On the other hand it must not however be forgotten how slight is the physiological action of the light of even the full moon on certain other vital processes such as assimilation.

487. Zuhr, E. 633.1–1.557
Ueber die ertragbildenden Werteigenschaften bei den Getreidearten. (**On the characters of value acting as components of yield in cereals.**)
Bl. PflBau. PflZücht. 1935 : **13** : 2–7.
In emphasizing the importance of an effective system of estimating yield in plant breeding, the views of numerous writers such as Mitscherlich, Heuser, Raum, Freudl, etc. on various main and subsidiary components of yield are cited. It is pointed out that the interactions between the various components must be taken into account in estimating yield and in any genetic research directed towards increasing it.

488. Stakman, E. C. 633.1–2–1.521.6:575(77.6)
Progress and problems in breeding disease-resistant cereals for the spring wheat region of the United States.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 49–51.
Examples are quoted to shew how the relative importance of the different diseases varies according to the varieties grown.
The effect of physiological specialization is also considered.
In general, considerable success has been achieved in breeding disease-resistant varieties of cereals.

WHEAT 633.11

489. 633.11 Gyllen
Walstedt, I. 633.11:575(48.5)
Svalöfs Gyllenvete (01140). [**Svalöf's Gyllen wheat** (01140).]
Sverig. Utsädesfören. Tidskr. 1935 : **45** : 131–41.
Gyllen, the new wheat from the cross Sol x Bore, is very winter-hardy, high yielding and resistant to rust.

490. 633.11 Skandia
Åkerman, Å. 633.11:575(48.5)
Svalöfs Skandiahöstvete (01090). [**Svalöf's Skandia winter wheat** (01090).]
Sverig. Utsädesfören. Tidskr. 1935 : **45** : 57–70.
A description of the new variety Skandia bred from the cross Kron x 0860d, a line from the old Fylgia wheat. The new wheat is very high yielding, has stiff straw and good baking quality.

491. TUMANJAN, M. G. 633.11(56.6)
Die wildwachsenden Verwandten der kultivierten Weizen in Armenien. (**The wild related forms of cultivated wheat in Armenia.**)
Z. Zücht. 1935 : A**20** : 352–63.
A German translation of the major part of the Russian paper abstracted in " Plant Breeding Abstracts " Vol. V, Abst. 78.

492. CLARK, J. A. and BAYLES, B. B. 633.11(73)
Classification of wheat varieties grown in the United States.
Tech. Bull. U.S. Dep. Agric. 1935 : No. 459 : Pp. 164.
A key to the varieties is given and a description of the distinguishing characters of each. The history of each variety, its distribution and its synonyms are also treated. There are numerous photographic illustrations of the spikes, glumes and kernels, and at the beginning a full and illustrated description of the characters used in identifying the varieties.
The bulletin concludes with an extensive bibliography and an index to the varieties.

493. PISSAREV, V. E. 633.11:551.566.3:575.1(47)
Das Problem der Verbreitung des Weizens nach Norden in der Sowjetunion. (**The problem of the northward extension of wheat in the Soviet Union**).
Züchter 1935 : **7** : 119–32.
Earlier work on the subject has already been reviewed (cf. " Plant Breeding Abstracts," Vol. III, Abst. 42). Further researches included the production of various types of wheats suitable for growth in the extreme north of the Union. The " *sibiricum* " wheats are very early ripening and do not require high temperatures to bring them to maturity. These have been successfully crossed with Marquis and from the crosses a strain of " Delta " wheat with the same type of grain as Marquis but earlier ripening has been obtained.
The " *ruthenicum* " group are later-ripening land wheats differing from the " *sibiricum* " group in a number of quantitative characters. Some of them are markedly xerophytic ; they provide rich material for breeding and some valuable strains have been bred from them.
Some of the spring wheats of India are of interest as they are even earlier ripening on the whole than the Siberian wheats but they require higher temperatures. The period from sprouting to earing is shorter but from earing to complete ripening is longer than in the Siberian group. Crosses between these have combined the earliness in both periods and produced a variety which ripens earlier than " *sibiricum*." Other valuable characters for breeding are found among the Indian and Afghanistan wheats. Wheats from Australia, Asia Minor, China, Canada, Scandinavia and France have also been tested.
Efforts made to increase the yield have included crosses between spring and winter varieties and the hybrids of a Swedish Squarehead with the local, early ripening Novinka are early spring Squarehead types with good vitreous grain of the Novinka type but a higher yield.
The breeding of wheat resistant to fungous disease presents greater difficulties as it involves crosses between *vulgare* wheats with *T. durum*, and *T. dicoccum* and *T. persicum*. Forms resistant to *Fusarium* and the fritfly are also needed especially for cultivation in the so-called " white patch " and have been found among *T. dicoccum*. Crosses have been made between such forms in *durum* wheats and from the progeny strains have been selected with a good grain which are immune to *Fusarium* and only slightly damaged by fritfly. The *asiaticum* Vav. type has also shewn a high immunity to *Fusarium* and also some of the wheats from Asia Minor. The production of suitable winter wheats for cultivation in the far north presents a number of complex problems. Some of the best results have been obtained by crosses between certain Russian wheats and Swedish wheats of the Squarehead type. Intergeneric crosses, such as those with rye and *Agropyrum* may also help towards a solution.

494. BIFFEN, R. H. 633.11:575
The thing we call wheat. Wheat breeding.
Miller 1935 : **61** : 365–71.
A review of wheat breeding since 1875.
About the turn of the century tests were made to see if hard wheats could be grown under English conditions and it was found in the case of Red Fife that strength was a varietal characteristic, only affected to a relatively small extent by environment. The yield of this variety was, however, too low for successful cultivation in England, and so, applying the then recently rediscovered principles of Mendelism, efforts were made to combine its quality with the high yield of English wheats. There appeared to be some " linkage " (a genetical phenomenon which was then just being discovered) between quality and yield, but by growing very large progenies and selecting, forms were obtained in the fifth generation combining the desired characters. One of the forms thus obtained was Yeoman. This wheat, while vastly superior in quality to other English wheats was somewhat erratic in yield, giving heavy crops under good conditions, but only average in the country as a whole. It has, however, served as a basis for the breeding of other hard wheats suited to soil conditions in different parts of the country, and is also being used in European countries for similar purposes.
It was also found in the early days that plant diseases could be controlled by plant breeders, and the breeding of varieties resistant to rust and other diseases has formed an important aspect of wheat breeding. In connexion with rusts the author refers to the difficulties introduced by the phenomenon of physiological specialization in the fungus and by linkage between undesirable characters and rust resistance. These have now largely been overcome and rust resistant bread wheats are available to cultivators. Other diseases are also being attacked by breeders, in some cases with success, e.g. mildew and smut, but in others, especially the " foot rots " with less success, owing to the difficulty of finding resistant forms.
Improvements have recently been brought about in the straw of wheat, whose standing capacity limits the yield to about 32 bushels per acre at present. Much stiffer forms have been produced, and also shorter types suited to mechanical harvesting.

495. NICOLAS, G. and CHALAUD, G. 633.11:575(44)
Le centre de sélection et de génétique de l'Institut agricole de l'Université de Toulouse en 1934. (**The centre for selection and genetics of the Institut agricole de l'Université de Toulouse in 1934**).
Progr. Agric. Vitic. 1935 : **103** : 471–75.
The behaviour of a number of strains and hybrids are described, their reaction to smuts and rusts being mentioned as well as their agronomic and baking qualities.
The work on wheat begun in 1922 is yielding satisfactory results and south-west France has now a range of forms suited to the varying needs of cultivators.

496. FOLLONI, A. 633.11:575(45)
I nuovi grani dello Strampelli. (**Strampelli's new wheats**).
Firenze Agric. 1935 : **8** : 351–59.
The origin, botanical and agricultural features of the following eight new wheats bred by Strampelli are described : Littorio, Roma Tevere, Ausonia, Sabaudia, Garigliano, Vettore and Apulia Precoce.

497. 633.11:575(52)
633.11:575.127.2(52)
WATANABE, T. 633.11–2–1.521.6(52)
(**Wheat**).
Bull. Hokkaido Agric. Exp. Sta. 1933 : **55** : 1–89.
Wheat cultivation in Hokkaido is increasing rapidly and certain promising varieties have been found. One winter variety, Akasabisirazu No. 1 from a Turkey Red x Martin's Amber cross is early and highly resistant to cold and rust. A spring variety, Nôrin No. 3, from an interspecific cross of Sapporo (*Triticum vulgare*) x Beloturka (*T. durum*) has very hard grain and is highly resistant to rust.

498. 633.11:575(73)
633.11(73)
CLARK, J. A.
Registration of improved wheat varieties, VIII.
J. Amer. Soc. Agron. 1935 : **27** : 71–75.
An account of wheat varieties approved for registration in 1934, their origin and performance. (Cf. " Plant Breeding Abstracts," Vol. III, Abst. 374).

499. 633.11:575(89)
633.11 Litoral
BOERGER, A. 633.11 La Estanzuela 1932
El cultivo triguero en su relación con los factores "variedad" y " epoca de siembra." (**Wheat cultivation and its relation to the factors " variety " and " time of sowing."**)
Rev. Minist. Industr. Montevideo 1935 : **2** : (4–5) : 9–23.
The question of varieties is discussed at some length and the author concludes that in view of the regional and annual variations it would be unsafe unduly to restrict the number of varieties under cultivation. A greater uniformity of product should be aimed at by producing varieties which though differing in agronomic features produce a grain of as nearly as possible the same type.
Some of the best varieties grown have been produced by the experiment station " La Estanzuela " and two further new varieties, Litoral and La Estanzuela 1932, from this station are described, with indications of their parentage. The former variety is distinguished by resistance to *Puccinia glumarum* and other rusts and to smut *Ustilago tritici*, the latter variety by its early maturity and resistance to *P. glumarum*. Similar descriptions of a number of imported wheats are included, with remarks on their resistance to lodging and best time of sowing.

500. TITTA, G. 633.11:575.1
Studi di genetica frumentaria. (**Studies in wheat genetics).**
Boll. Ist. Agric. Pisa 1934 : **10** : 94–134.
The methods used for obtaining élite strains of wheat are described in some detail. Of the 14 strains retained up to the present, one is a selection from the variety Campio and the rest the products of hybridization. The botanical and agricultural features of the new strains are illustrated and described.

501. GOYTIA y ANGULO, M. de 633.11 *T. durum* : 575.11
La herencia de algunas caracteristicas en los trigos duros. (**The inheritance of certain characteristics of *durum* wheats.**)
Bol. Inst. Invest. Agron. Madrid 1935 : **1** (2) : 153–63.
An Egyptian variety of *Triticum durum*, characterized by a yellow coloration of the plant at the period immediately preceding maturity, has been crossed with local forms of *T. durum* from the neighbourhood of Jerez and with the variety Senatore Cappelli in order to increase the earliness and reduce the height of these varieties. All the F_1 plants possessed the yellow coloration and segregation occurred in the F_2 in both crosses. By the use of the *chi*-square method it was found that no family differed significantly from the ratio 3 yellow : 1 green.
The local wheat had red glumes whilst Senatore Capelli was white, the F_1 being intermediate. The F_2 shewed different degrees of colour but when grouped into red and white gave significant 3 : 1 ratios. Four white plants with red flecks were also found, the further behaviour of which is to be studied.
Awn colour was studied in a cross of Obispado (*T. durum* var. *affine*) with white awns and Senatore Capelli with black awns. The majority of the F_2 plants had black awns, which were dominant in F_1, but no exact ratios could be compiled owing to difficulty of classification.
Grain colour was studied in the same cross with Obispado and proved to be dependent on two factors.
The hollow straw of Senatore Capelli proved partially dominant to the solid straw of Obispado, with great variation in the degree of solidity in the F_2. The results can possibly be interpreted on a bifactorial basis, but this is to be verified in the F_3.

502. 633.11:575.11:581.46
BJAANES, M. 633.11:575.11.061.6
Nedarving av snerp og aksfarge hos vårkveite. (**The inheritance of awns and ear colour in spring wheat.**)
Meld. St. Forsøksgard Møistad 1933 : Pp. 24.

Crosses were made between the Canadian variety Garnet with very short awns and white ears and the Svalöf varieties Rubin and Diamant and the Norwegian varieties Frøya and Ås, all with short awns and brown ears. F_1 was awnless and the ear brown. Segregation in F_2 gave besides the short awned parent form, two new types, one completely awnless and the other with long awns.

Further experiments confirmed the assumption that Garnet possesses a dominant factor *B* inhibiting awns and the other wheats another dominant cumulative factor *A* inhibiting awns though not quite as strongly as *B*. The awnless type is therefore *AABB* and the long awned type the double recessive *aabb*.

Crosses were also made between the four short awned Scandinavian types and a long awned variety, Huron, and the results shewed that a single dominant factor *A* differentiates short from long awns.

503. KIHARA, H. and WAKAKUWA, S. 633.11:575.127.2:576.312.35
Weitere Untersuchungen über die pentaploiden *Triticum*-Bastarde IV. (**Further investigations on the pentaploid *Triticum*-hybrids. IV.**)
Jap. J. Bot. 1935 : **7** : 381-87.

In continuation of previous work (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 125) back-crosses were made between the F_1 from *T. polonicum* x *T. Spelta* and *T. Spelta* and *T. polonicum* respectively, special care being taken with the pollinations, germination and rearing of the seedlings. A very high percentage of successful crosses was obtained, over 80 per cent in both crosses. The combination F_1 x *T. Spelta* was somewhat the less successful ; the viability of the seedlings was markedly lower and 18 plants died.

On cytological examination of root tips of the surviving plants the difference previously found between hexaploid and tetraploid pollen as regards the frequency of fertilization of high and low chromosome egg cells respectively was no longer observable. Under optimum conditions of fertilization the two equational crosses give similar results.

The aberrant distribution due to chance of the seven unpaired chromosomes explains the remarkable difference found between the variation series for the egg cells with the various chromosome numbers and the theoretical expectation.

Certain other anomalous chromosome numbers are noted and the morphology of the pollen of the pentaploid hybrids is described. About 90 per cent appeared normal though presumably not all were equally sound functionally.

504. 633.11:575.127.2:576.354.356
HOSONO, S. 633.11:576.312.36
Karyogenetische Studien bei reinen Arten und Bastarden der Emmerreihe I. Reifungsteilungen. (**Karyogenetic studies with pure species and hybrids of the Emmer series. I. Maturation divisions**).
Jap. J. Bot. 1935 : **7** : 301–22.

Twenty-one different combinations were obtained from crosses of seven varieties of the tetraploid species :— *Triticum polonicum* L., *T. dicoccum* Schübl., *T. durum* L., *T. dicoccoides* Körn., *T. turgidum* L. and *T. persicum* Vav. The reciprocal crosses were also made giving a total of 42 combinations.

In the pure species pollen mother cells with univalents rarely occurred, the highest frequency being 4·2 per cent in the 120 pollen mother cells examined of *T. durum*. Moreover there were never more than two in any cell. In the F_1 hybrids, except in two crosses, similar conditions were found and the occurrence of univalents is therefore attributed to chance failure in pairing. In the two exceptions *T. dicoccoides* x *polonicum* and *T. dicoccoides* x *durum* and their reciprocals about 9–11 per cent of the pollen mother cells examined shewed 1–2 univalents. It seems likely

therefore that here weakness in pairing may be due to slight differences between the partners of a chromosome pair.
If *T. polonicum* x *durum* be excepted, it appears that the cells with over two and even four univalents occur most often in those combinations with the highest number of cells with two univalents viz. *T. dicoccoides* x *durum* and *T. polonicum* x *dicoccoides*. The frequency of cells with univalents varied with season of the year, direction of the cross and date of fixing.
The relative value of these findings and those of previous workers is discussed.
The occurrence of multivalent associations, quadrivalents in particular and the morphology of such configurations in the species and the hybrids are discussed. In the pure species they occurred sporadically or not at all. In the hybrids generally one and rarely two such associations were found per cell in almost all combinations, the highest frequency of such cells being about 35 per cent, in the *T. dicoccum* x *dicoccoides* cross.
The nature of the existing homology—whether partial or complete—and the reasons for the rarity of multivalent association in the pure species are considered.
As regards fertility, *T. dicoccum* x *durum* which had approximately 31 per cent pollen mother cells with quadrivalents was 90 per cent fertile and up to F_3 no sterile plants have been detected ; and allowing for the effect of the Japanese climate upon wheats that were not indigenous, hybrid sterility seems to be very unlikely.
From the foregoing it is concluded that one or two chromosomes of the A genom have parts in common with one or two of the B genom, as a result possibly of duplication.

505. KATTERMANN, G. 633.11:575.127.5:633.14:576.354.46
Die Paarungsintensität der Chromosomen bei Weizen-Roggenbastarden zweiter Generation im Vergleich zum Weizenelter. (**The intensity of pairing of the chromosomes in second generation wheat-rye hybrids in comparison with the wheat parent.**)
Planta 1935 : **24** : 66–77.

Chromosome conjugation was studied at metaphase I in the pollen mother cells of the back-cross progeny derived from free crossing between wheat-rye hybrids (Cf. " Plant Breeding Abstracts " Vol. IV, Abst. 955 and Vol. V, Abst. 77) and certain races of wheat closely related to the maternal wheat parent of the hybrids.
First of all the numbers of double-rod shaped bivalents per nucleus was determined in a number of pollen mother cells of different plants and the distribution for each plant tabulated. Great variability was shewn, and the numbers for each plant formed an asymmetric series with a maximum frequency which was displaced somewhat towards the side with low numbers of rod shaped bivalents. Corresponding distributions were drawn up for the ring bivalents, great variability being again discovered. In each case the number with maximum frequency increased as the chromosome number of the plant increased, but more noticeably in the case of the ring bivalents.
From the same figures were calculated the percentages of rod and ring bivalents respectively in the different hybrid plants and also in the pure wheat races corresponding to the wheat parents of the original crosses. The numbers thus obtained were taken as measures of the " firmness " of pairing (i.e. whether the chromosomes were connected on one side or on both sides of the spindle fibre attachment point). The method is not as accurate as chiasma analysis, but is much simpler and is considered sufficiently accurate for comparisons between the hybrid plants and between these and their wheat parents. The numbers were expressed as percentages of the total bivalents, and clearly shew a reduction in pairing intensity in the hybrids as compared with the pure wheat races, though, since univalent chromosomes were not considered, only wheat chromosomes are concerned in each case.
The figures were also expressed as " connexions per chromosome," giving the average number of connexions (not chiasmata) per chromosome capable of pairing, for each plant, the number of chromosomes capable of pairing being derived from the total number of chromosomes by subtracting the minimum number of univalents found in that plant. In the hybrid plants as compared with the pure wheat races, this figure also shewed a reduction, varying from 6 to 34 per cent in different plants.

The results are discussed in relation to the question whether the wheat genom is unchanged after hybridization with rye and it is suggested that the results given may indicate that structural alteration takes place as a result of autosyndesis in wheat-rye hybrids. Other factors which might be concerned in the decrease in pairing are the differences between the egg nuclei of the F_1 hybrids and the diversity of races of wheat used in back-crossing.

506. WAKAR, B. A. 633.11:575.127.5:633.289:576.312
Cytologische Untersuchung der ersten Generation der Weizen-Queckengrasbastarde. (**A cytological investigation on the first generation of wheat-couch grass hybrids.**)
Züchter 1935 : **7** : 199–206.

The crosses were made with *Agropyrum elongatum* and *Triticum vulgare* Hope, *T. vulgare caesium* 0111, *T. vulgare* Baart x Hussar and *T. durum* Nosatovski C–174. The hybrids were all markedly winter-hardy.

A cytological examination shewed that irregularities were marked and frequent. In the crosses of *Agropyrum* with the *vulgare* wheats 42 units were usually counted at metaphase of the first division and indirect evidence suggests that these represent 14 bivalents and 28 univalents. In the cross with *T. v. caesium*, however, 35 units, 14 univalents and 21 bivalents were observed, though more rarely.

The genoms of *vulgare* wheat can be represented by *A*, *B* and *D*, those of *Agropyrum* by the same *A*, *B*, *D* and by X_1 and X_2. One of the wheat genoms has a weaker affinity than the other for the corresponding genom in *Agropyrum*, as it does not always conjugate. In the first cross, with 14 bivalents, the formula $AA_1 + BB_1 + D + D_1 + X_1 + X_2$ is assumed while that with 21 bivalents is $AA_1 + BB_1 + DD_1 + X_1 + X_2$.

There was a considerable amount of lagging at anaphase or even fragmentation of the chromosomes, leading to the formation of completely sterile pollen.

At metaphase I of the hybrids with *T. durum* two types were encountered, one with 35 chromosomes and the other with 28. These represent in one case 14 bivalents and 21 univalents and in the other 21 bivalents and 7 univalents, the formulae being $AA_1 + BB_1 + D_1 + X_1 + X_2$ and $AA_1 + BB_1 + D_1 + X_1X_2$. The reduction division was very irregular and the pollen grains were sterile.

The similarity of both sets of hybrids to each other and their greater similarity to the *vulgare* wheats is due, it is assumed, to the presence in both series of the *D* or D_1 genom characteristic of the *vulgare* wheats.

507. 633.11:575.129:633.14
LINDSCHAU, M. and OEHLER, E. 633.11:575.127:633.14:576.3.356.5
Untersuchungen am konstant intermediären additiven Rimpau'schen Weizen-Roggenbastard. (**Investigations on the constant intermediate additive Rimpau wheat-rye hybrid**).
Züchter 1935 : **7** : 228–33.

On the history, morphological characteristics, cytological behaviour and fertility of a number of constant intermediate hybrids raised from seed derived from a wheat-rye hybrid originally grown from seed of Rimpau's famous wheat-rye hybrid material.

The writer's cytological findings agree with those of Levitsky and Benetzkaia (Cf. " Plant Breeding Abstracts," Vol. I, Abst. 506, and Vol. II, Absts. 594 and 595) and the chromosome number was again found to be 2n = 56. Possible ways in which the doubling of the chromosomes in this hybrid may have occurred are mentioned, though an exact explanation of the origin of Rimpau's hybrid is by now admittedly impossible.

508. 633.11 *T. monococcum* : 576.356:537.531
CÂMARA, A. DE SOUSA DA 633.11:576.16:576.356
Efeitos dos raios-X nos cromosomas do *Triticum monococcum*. Sua análise na apreciação da filogenia do trigo. (**Effects of X-rays on the chromosomes of *T. monococcum*. Their analysis in relation to the phylogeny of wheat**).
An. Inst. Sup. Agron. Lisboa 1935 : **7** : 29–61.

Seedlings varying in age from one to ten days were treated with X-rays. The first effect of the treatment was the supression of mitosis, and when it was gradually resumed after a few days, it

was accompanied by a number of anomalies of division. Various chromosome aberrations observed, including translocations, fragmentation etc., are described and illustrated. An examination of a large number of fragments shews that these are frequently of the same size and shape suggesting that there are certain points at which fragmentation tends to occur, the attachment constriction being apparently one of these and the secondary constrictions possibly others. Two cases of deletion in a single chromatid are illustrated, shewing that the phenomenon occurred after cleavage. A further point of interest is that frequent unmistakable cases of translocation were observed in which no sign of a constriction at the point of interchange was detectable.

Haploid cells and even whole sectors consisting of haploid cells were observed in certain of the root tips ; many tetraploid cells were also detected and it is thought probable that entire plants with the haploid or tetraploid number may occasionally be produced by this method.

In reviewing the various species of *Triticum* and their inter-relationships, the author points out that among the great wealth of wild diploid species some, *T. Thaoudar* in particular, shew very close resemblance to *T. dicoccoides* and the tetraploid series, and it is thought probable that they have given rise to tetraploids by chromosome duplication, followed by chromosome variation of a nature similar to that observed under the influence of X-rays. The presence of duplicate genes in the hexaploid wheats would indicate an origin either by autopolyploidy or by hybridization with a species having a certain number of identical genes. In this connexion it is pointed out that Delaunay obtained a mutant *mutica* from *T. vulgare*, a character associated with *Aegilops ovata* and *Ae. cylindrica*, two of the possible alternative parents of the hexaploid wheats.

Four characteristic new chromosome types were encountered with particular frequency in the irradiated material and if these four types are added to the seven basal chromosomes it is possible to produce all the chromosome types described by Kagawa as characteristic for the tetraploid species *T. dicoccum*. Other types were naturally also present but the author contends that it is possible by a simple evolutionary process, consisting of fragmentation, segmental interchange etc., to produce from the diploid wheat chromosomes all those forms characteristic of the tetraploid series, without the intervention of any other process such as hybridization. It was further observed in the X-ray material that only one of each chromosome pair was ever affected in the same way, and this would therefore explain the existence of only one of each type even if the tetraploid has originated by duplication.

509. NAKAJIMA, G. 633.11:576.356.52
Occurrence of a haploid in *Triticum turgidum*.
Jap. J. Genet. 1935 : **11** : 246–47.

Previous instances of haploidy in *Triticum* are enumerated.

The present specimen arose from a *T. turgidum* (2n = 28) x *Secale cereale* cross which yielded 182 kernels from which two plants were successfully raised. One was an F_1 hybrid and the other a haploid. When the latter matured it had two leaves about 10 cm. long and 6 mm. wide, a purplish culm 10 cm. long and an ear with 6 spikelets. On the whole it resembled the wheat parent and had 14 chromosomes in the root tips. Its pollen grains differed somewhat in size.

This plant must have arisen by parthenogenesis following stimulation by the pollen tubes of *S. cereale*.

510. SHEN, L. Y. 633.11:581.143.26.03
(**Preliminary report on a wheat vernalization experiment**).
Spec. Publ. Nat. Agric. Res. Bur. Nanking 1934 : No. 4 : Pp. 12.

Seventeen varieties were used, 13 being winter varieties from North China. All varieties were treated in the following ways.

(A.) Seed germinated for 24 hours at 50°–60°F. on 10th February, 1934 then placed in a refrigerator at 38°F. for 48 days and planted out on 31st March.

(B.) Similar to A except that the seed was kept out-of-doors at an average temperature of 46°F. from 10th February to 31st March.

(C.) Seed was germinated on 30th March and planted the following day.

(D.) Seed was sown on 31st March without any previous treatment.

Results.
In (A) and (B) the period from sowing to heading was 131–145 days shorter than the control sown 20th October, 1933. There was practically no difference between the results of treatments (A) and (B).
Only six varieties from (C) headed and these not till the beginning of July.
Only one variety of (D) headed. This was an early variety.
Taking this early, untreated variety as a standard, 12 of the 17 varieties vernalized headed earlier and all shewed an increased yield.

511. Heuser, W. and Boekholt, K. 633.11–1.557:575
Ertragsanalytische Untersuchungen an Kreuzungsstämmen von Winterweizen zur Kenntnis der Vererbung der Ertragsstruktur. (**Analytical investigations of yield on hybrid strains of winter wheat, for acquiring a knowledge of the inheritance of yield structure**).
Pflanzenbau 1935 : **11** : 321–33.
Yield structure, whose primary components are density of stand, number of grains per ear and weight of the individual grain can, it is stated, be determined by a morphological analysis of yield and has been shewn to be a varietal character. Hence in cross-breeding winter wheats the respective types of yield structure of the two parent varieties must be taken into account if the ultimate desired type is to have a particular yield structure.
The yield structure of a number of strains obtained from two wheat crosses is analysed and its importance as a basis in the selection of élite plants from a hybrid population is also indicated.
One of the main advantages to be derived from studies of varieties from this aspect is the possibility offered of obtaining forms suitable to particular environmental or other conditions by breeding specially for some particular component or components of yield structure.

512. Moussouros, B. G. and Papadopoulos, D. C. 633.11–1.557:575"793"(49.5)
Correlating yield with phenological averages to increase efficiency in wheat breeding.
J. Amer. Soc. Agron. 1935 : **27** : 715–23.
Yields of 99 varieties of wheat, of different degrees of earliness, were measured in single or replicated plots over a period of 4 years, during which time weather conditions fully representative of those obtaining in Greece were encountered.
Highly significant negative correlations were obtained between yield and number of days to heading in each year and, in three years, between yield and number of days to maturity, while high positive correlations were obtained between yield and number of days from heading to maturity.
The first and third of these correlations are taken as indicating the truth of the conclusion arrived at by previous workers, that early varieties are needed for conditions in Greece, where there is a very dry summer. Earliness of maturity is to some extent merely a secondary attribute of earliness of heading, fluctuating more with weather conditions.
The varieties to be grown should not, however, be earlier than Ballila, which heads during the first 10 days of April in Athens, if they are to avoid the early spring frosts. Since the advantage of the early wheats depends largely on their longer maturing period, attention should be devoted to obtaining early heading strains possessing drought resistance in order to extend their maturing period.

513. 633.11–2.451.2–1.521.6:575
Tavčar, A. 633.11:581.46
Lodicules et culture de froment résistant au charbon. (**Lodicules and the cultivation of smut-resistant wheat.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial Yougoslavie. Sect. IV : Thème No. 2 : Pp. 9
Of the two most widely grown winter wheats in Jugoslavia, the variety " Prolific " suffers more in the field from *Ustilago tritici* Jens. than does Banat wheat. In view of the fact that infection

takes place by way of the open flower and that no difference could be distinguished between these two varieties under conditions of heavy artificial infection, it was thought that this difference in the field might be due to differences in the extent and duration of flower opening.
It was found, when pure lines of the two varieties were studied, that the flowers of Prolific were more widely open than those of Banat wheat, as shewn by the angle between the inferior and superior palea and their lengths ; similarly, Prolific flowers remained open on an average some three minutes longer than those of Banat wheat. Minor differences were also found between different pure lines of the varieties.
These differences were found to correspond with differences in the dimensions of that part of the lodicules which swells and causes the palea to separate, and were, moreover, correlated with differences in field infection by *Ustilago tritici*.
It is suggested therefore that in breeding for resistance to this disease selection on a basis of lodicule size should be useful.

514. Sibilia, C. 633.11–2.452:576.16
Ricerche sulle ruggini dei cereali. La specializzazione della "*Puccinia triticina*" Erikss. in Italia. (**Researches on cereal rusts. The specialization of "*P. triticina*" Erikss. in Italy.**)
Boll. Staz. Pat. Veg. Roma 1935 : **15** : (N.S.) : 177–300.
After a description of the houses specially designed for the cultivation of the fungi and their hosts and the methods employed, the distribution of physiological forms throughout Italy is noted. From a collection of 24 monosporidial cultures, 9 biotypes were determined and the reaction of these was tested on a number of wheat varieties.

515. 633.11–2.452–1.521.6:575.42(44)
633.15:575(44)
Lathouwers, M. V. 635.652:575.42(44)
Rapport sur une mission effectuée au Congo belge (mars-août 1932). [**Report on a mission accomplished in the Belgian Congo (March-August 1932).**]
Bull. Inst. Colon. Belge 1933 : **4** : Pp. 23.
The purpose of the tour, which was on behalf of the Institut Royal Colonial Belge, was to organize the breeding of certain economic plants and to inspect the stations concerned with the improvement of cotton, coffee, rubber and *Elaeis*.
At Nioka, infection plots were established for the selection of rust-resistant wheats, attacks by rust being the most important cause of low yields in this colony. The details of the programme recommended by the author for succeeding years are given. Efforts are to be directed to the production of rust-resistant forms by pure line selection, but recourse may be had to hybridization if necessary.
At Nioka and Dele, a method for the improvement of maize was recommended, involving the purification, to a certain extent, of the populations existing at present, followed by the utilization in a modified way of hybrid vigour.
The selection of pure lines was recommended for the improvement of beans (*Phaseolus vulgaris* and *P. lunatus*).
The lines of work and the personnel of other stations visited are reported.

516. Draghetti, A. 633.11–2.452–1.521.6:581.44:575.11
L'importanza dello studio dell'internodo superiore del culmo di frumento nella costituzione di varietà agrariamente refrattarie alle Puccinie. (**The importance of the study of the upper internode of the wheat culm in the production of varieties resistant to *Puccinia*.**)
Ann. Staz. Sper. Agr. Modena 1934 : 1934 : **3** : (N.S.) 247–62.
A study of the histological and morphological characters of the upper internode shewed that the number of stomata in the internodes increased successively from the base upwards. The coefficient of variability in length of the internodes increases from the base to the uppermost but one and decreases slightly for the upper internode.

For the investigation on the resistance to rusts of the upper internode 40 F_2 hybrid progenies were used from crosses between 12 varieties of wheat both resistant and susceptible.
The distribution of infection on the upper internode was found to be least at the base, rising to a maximum at the apex, corresponding to the higher osmotic pressure of the sap in that region.
Three types of segregation were observed among the hybrid progenies, (a) with a 1 : 2 : 1 ratio of resistant, intermediate and susceptible (b) with 71.8 per cent resistant, 23.6 per cent intermediate and 1.6 per cent susceptible from a cross between two resistant varieties and (c) with 74.2 per cent intermediate, 25.8 per cent susceptible and no resistant types from a cross between two susceptible varieties.

517. DESPREZ, F. 633.11:664.641.016
La valeur boulangère des blés. (**The baking value of wheats**).
Vie Agric. Rur. 1935 : **24** : 142–44.
An article to demonstrate the following conclusions reached by the French plant breeders' association last year :—
Baking value remains still an ill-defined character and the results obtained from its estimation by existing methods must be received with caution. Certain environmental factors (e.g. locality and climate) influencing the determination of quality are mentioned.

518. SILVELA, F. 633.11:664.641.016
La calidad panadera en los trigos. (**The baking quality of wheats**).
Agricultura, Madrid 1935 : **7** : 719–24.
Remarks are given on the methods of determining baking quality and the results of tests on a number of imported wheats and local varieties and selections.

519. BOERGER, A. 633.11:664.641.016(89)
Die Mehlqualität der Handelstypen von La Plata-Weizen unter züchterischen Gesichtspunkten. (**The flour quality of the commercial types of La Plata wheats from the breeding standpoint**).
Züchter 1935 : **7** : 233–44.
Quality in La Plata wheats is discussed from the standpoint of the export trade.
The need for standardizing commercial wheats on a varietal basis is made clear by numerous examples from analysis of commercial types, some of which were found to contain undesirable varieties and in very high proportions. (Cf. " Plant Breeding Abstracts," Vol. III, Abst. 635, and Vol. IV, Abst. 141).

520. 633.11:664.641.016:575(43)
ROEMER, T. 633.14–1.547.1:575"793"
Ziele der Qualitätszüchtung bei Weizen und Roggen und ihre Bedeutung für Müllerei und Bäckerei. (**Aims in breeding for quality in wheat and rye and its importance for milling and baking**).
Süddsch. Müllerz. Leipzig 1935 : **56** : 638–41.
The economic importance for Germany of increased wheat production and the measures that have been and are being taken to improve the quality are dealt with at some length. The various requirements which must be met in the breeding of new forms and the various methods at the breeder's disposal for determining the quality of wheat samples are outlined.
As regards rye, no work has yet been done in Germany on possible varietal differences in quality but from Russian and Polish studies it appears unlikely that such differences exist. Quality in rye is affected by the initiation of the early stages of the germination processes by rain during harvest. For this reason the breeding of races of rye characterized by delayed germination is recommended. Forms of this kind have been obtained by the author in barley and oats.

521. 633.11.00.14(43)
633.11:664.641.016
WAHLEN, F. T. and WAGNER, S. 633.11–2.183
Anbauversuche und Qualitätsprüfungen mit Winterweizensorten. (**Cultural experiments and quality tests with winter wheat varieties**).
Landw. Jb. Schweiz 1935 : **49** : 665–92.
In these variety trials of eight Swiss and one foreign winter wheats no correlation was found between low yield of straw and resistance to lodging. The specifically varietal characteristics composing quality, e.g. gluten quality, yield of dough, etc, are discussed as well as their correlations. In dealing with the performance of the individual varieties their qualitative characteristics are enumerated.

OATS 633.13

522. 633.13:575(73)
STANTON, T. R. 633.13(73)
Registration of varieties and strains of oats, VI.
J. Amer. Soc. Agron. 1935 : **27** : 66–70.
Descriptions of varieties approved for registration in 1934, their origin and performance.

523. 633.13–1.557
BARBEE, O. E. 633.13–2.451.2–1.521.6
Markton and other varieties of oats.
Bull. Wash. Agric. Exp. Sta. 1935 : No. 314 : Pp. 44.
Varietal characteristics of oats, including resistance to smut (*Ustilago levis* K. and S.), are described and various correlations between them and yield were examined.

524. NICOLAISEN, W. 633.13–2.451.2–1.521.6:575
Untersuchungen mit Herkünften des Haferflugbrandes im Rahmen der Immunitätszüchtung. (**Investigations with collections of loose smut of oats from different sources from the standpoint of breeding for immunity.**)
Z. Zücht. 1935 : A**20** : 318–45.
In 1933 and 1934 twenty-nine test varieties of oats were infected with twenty-seven samples of *Ustilago avenae* and a mixture of all the samples to determine (a) the behaviour of the varieties in their resistance to the collections of loose smut and as a result, their value as parents in breeding for immunity ; (b) the specific pathenogenicity of the collections to the test varieties, and (c) whether there is any change in the pathenogenicity of the organism due to a mixing of the samples.
Of the large number of varieties used hardly one resembled any other in its behaviour to all the samples and a number of factors determining resistance must therefore be assumed. In the same way it was hardly possible to find two samples of smut of equal virulence.
The oat varieties are briefly described and their reaction to the different samples indicated. The results are also given in tabular form.
Details of the origin and behaviour of the various samples are given and the results of the selective action of the host plant are discussed.

525. 633.13–2.452–1.521.6:575.11
SMITH, D. C. 633.13–2.452:581.4
Correlated inheritance in oats of reaction to diseases and other characters.
Tech. Bull. Minn. Agric. Exp. Sta. 1934 : No. 102 : Pp. 38.
The inheritance of reaction to nine physiological forms of stem rust, *Puccinia graminis avenae*, in the F_2 and F_3 generations of crosses between Gopher and Rainbow oats indicated the probable existence of a multiple allelomorphic series governing reaction. Resistance, which was dominant, was inherited independently of the complex of characters made up by lemma colour, basal

hairs of the grain and presence, length and strength of awns. It was also independent of culm diameter and breaking strength of straw, the latter, moreover, shewing no significant agreement in succeeding generations. Percentage of blast in the F_3 families, which was also independent of rust reaction, was significantly correlated with lateness of heading.
The inheritance of resistance to crown rust, *P. coronata*, was also studied in a number of crosses, but no factorial scheme to explain it is advanced. In F_1, seedling resistance was dominant in some crosses and intermediate in others, adult resistance being intermediate. In one cross resistance was associated to some extent with lateness, but the possibility of obtaining early maturing, resistant types was established.

526. 633.13.00.14(73)
633.13–2.451–1.521.6(73)
633.13–2.111–1.521.6(73)

Results from the cooperative coordinated oat breeding and uniform winter-hardiness nurseries in the United States 1923–1934.
U.S. Dep. Agric. Bur. Pl. Ind. 1935 : May 8 : Pp. 74.

Co-ordinated tests of oat varieties and strains have been made from 1925 to 1934 at some 64 stations, the types tested being midseason smut resistant oats, early maturing and autumn sown oats, while uniform winter-hardiness trials have also been carried out. This method of testing ensures the speedy recognition of valuable strains and the discarding of mediocre or valueless forms, which are replaced by newer strains developed by the co-operating stations.
The results obtained during the ten years mentioned are tabulated.

RYE 633.14

527. Heuser, W. 633.14–1.557:575.125

Abschliessende Versuche zum Problem des " Maultierroggens." (**Concluding experiments on the problem of " Maultierroggen."***)
Landw. Jb. 1935 : **81** : 577–83.

Continuing the study of the problem of heterosis effects in the yield obtained in the F_1 from two varieties of rye, sown in such a way as to allow of cross-fertilization, data were collected on the yield from field experiments where crossing could occur and from isolation shed experiments in which conditions for cross-fertilization were specially favourable. In the latter case a definite rise in the yield of the so-called F_1 was demonstrated. It appears that the less favourable are the conditions for crossing, the less marked is the heterosis effect and in extreme cases even reduced F_1 yields (as compared with the yield from the more productive parent) may result. Hence the heterosis effect observed cannot be utilized in practical cultivation and it is recommended that unmixed varieties of rye should be grown.
Incidentally experiments shewed that manuring did not influence the effect of heterosis. (Cf.. " Plant Breeding Abstracts," Vol. I, Abst. 345.)

MAIZE 633.15

528. Lecat, M. 633.15:575(44)

Rapport sur les travaux de la Station pendant l'année 1934. (**Report on the work of the Station during the year 1934**).
Sta. Génet. Cult. Mais., Chambre Agric. Basses-Pyrénées, Pau 1935 : Pp. 40.

Improvement of the local varieties of maize is in progress, using the " half ear to row " method of selection. The work was much hampered by a storm, which however provided a severe test of resistance to lodging.
Several imported varieties are under observation and of these certain Czech varieties appear promising, though in need of acclimatization.
Two crosses and their reciprocals have been made between local varieties and imported forms in the hope of utilizing the resultant hybrid vigour and of improving the form of the grain and ears of the local varieties.

* Maultierroggen is used to designate the so-called F_1 from two varieties of rye which have been sown as a mixture and undergone mutual pollination, resulting under the most favourable conditions in 50 per cent. of true F_1 plants and 50 per cent. of the parent varieties.

529. KVARAN, P. 633.15:575(49.7)
La situation actuelle de la culture du mais en Yougoslavie. (**The present position of maize breeding in Jugoslavia.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial Yougoslavie. Sect. IV : Thème No. 2 : Pp. 5.
Maize breeding in Jugoslavia began a few years before the war and consisted chiefly in mass selection. Recently however the author has carried out extensive work on the production of single and double-cross hybrids, some of which have given very promising results.

530. WALLACE, H. A. 633.15:575(73)
Six decades of corn improvement and the future outlook.
Iowa St. Coll. J. Sci. 1935 : **9** : 561–66.
The early development of maize breeding is reviewed. From 1874 to 1893 it was chiefly in the hands of the farmers themselves, from 1893–1910 the colleges and experiment stations took the lead, from 1910–1920 interest was increasing, stimulated by the ear to row breeding, crossing of varieties, and variety yield testing of the experimental stations ; only since 1920 has a comprehensive scientific approach to the problem been employed, with more carefully conducted yield tests and the realization of the commercial significance of crossing inbred lines. The first work on crossing inbred lines was performed by Shull of the Carnegie Institution and East of the Connecticut Experiment Station from 1905 to 1911, but it was not until 1920 that several workers took up the idea and began developing methods for its practical utilization. The method developed rapidly and such factors as stiffness of stalk, drought resistance and disease resistance began to be considered as well as yield.
At the same time there was considerable development in the pure genetics of maize, and a connexion between this and maize breeding has been established by work on the yields of plants carrying certain genetic factors.
Future development, apart from the application of what has already been discovered, will, it is suggested, take the form of creating different types for different purposes.

531. RHOADES, M. M. and 633.15:575.1:576.312
MCCLINTOCK, B. 635.67:576.312.32
The cytogenetics of maize.
Bot. Rev. 1935 : **1** : 292–325.
In all about 400 genes are known in maize affecting sporophyte, gametophyte or endosperm characters and about half of these have been placed in one or other of the 10 linkage groups. The latter have been identified with their corresponding chromosomes by work on trisomics, on reciprocal translocations and on deletions ; reciprocal translocations and deletions have also been utilized to determine the loci of certain genes cytologically, chromosome fragments also having been used for the same purpose.
The fact that crossing-over takes place between chromatids has been demonstrated genetically by the use of trisomic plants carrying marking genes in the extra chromosome at different distances from the spindle fibre attachment, and cytologically by the anaphase I separation of paired chromosomes, one of which has a segment inverted. The cytological demonstration of the exchange of segments in crossing-over has been performed in a number of different ways. In *Zea-Euchlaena* hybrids it has been shewn that end-to-end association of arms of chromosomes at diakinesis is associated with crossing-over in those arms, and furthermore that post-diplotene association was confined to a particular segment in which genetic crossing-over was known to occur, the frequency of chiasmata being approximately twice the amount of crossing-over.
Studies have been made on a number of chromosome structural rearrangements, such as translocations, inversions, deletions and ring chromosomes, and chromosomes with broken spindle fibre attachments. Two important conclusions have resulted, namely that broken ends of chromosomes tend to unite, two by two, and that a broken piece of a spindle fibre attachment can function in the spindle figure.
From studies on meiotic chromosome associations in complements which were numerically or structurally unbalanced, four conclusions have been arrived at regarding synapsis, namely :

that homology is the main force controlling the movement of homologous parts of chromosomes towards each other, that association once started between homologous parts tends to continue along the chromosomes, that when three homologous parts are present association at any given level is only between two of them and lastly that there is a tendency for all parts to associate in pairs regardless of whether or not they are homologous.
In normal diploids there is no conflict between these factors, but in some unbalanced forms conflict does occur, often yielding unexpected results. Non-homologous association usually disappears at diplotene and is accompanied by crossing-over, but there is evidence that occasionally translocations occur between associated non-homologous parts.
Eight of the ten possible primary trisomics, one secondary trisomic and numerous tertiary trisomics have been discovered in maize, as well as many deficiencies of varying sizes, the transmission through eggs and pollen having been studied in detail. Normally such anomalies cause reduction in vigour, but in Black Mexican sweet corn a type of chromosome occurs which can be carried in excess of the normal complement without appreciable effect on vigour, as many as 25 having been added to the normal diploid complement. Meiotic prophase studies of such chromosomes suggest that they are largely composed of genetically inert material. Haploid, triploid, tetraploid and octoploid forms have been discovered, the first and second occurring spontaneously, the others resulting from heat treatment of the ears.
Hybrids have been made with *Euchlaena* and with *Tripsacum*, the former easily, the latter with difficulty, and a trigeneric, trigenomic hybrid has also been produced involving all three genera. The cytology of these hybrids has also been studied (Cf. " Plant Breeding Abstracts " Vol. VI, Abst. 173.).

532. 633.15:575.12
SMITH, G. M. 635.67:575.12
Golden Cross Bantam sweet corn. Its development and distribution.
Canning Age 1935 : **16** : 171–73.
A full account of the production and distribution of this variety already described from another source (Cf. " Plant Breeding Abstracts," Vol. III, Abst. 644).

533. SOSA-BOURDOUIL, C. 633.15:575.127.5:581.192
Note biochimique sur l'hybride *Zea Mays* x *Euchlaena mexicana* en première génération. (**Biochemical note on the hybrid Z. *Mays* x *E. mexicana* in the first generation.**)
Rev. Bot. Appl. 1935 : **15** : 615–18.
A description is given of the seeds of the above hybrid obtained from a cross made by M. Miège at Rabat and its chemical composition. Compared with the ♀ parent the hybrid seed shewed a marked increase in nitrogen content, although the content of carbohydrates remained just as high as that of the parents. Hence it seems likely that a crossbred race could be isolated with a relatively high nitrogen content without any accompanying reduction in the starch content.

534. 633.15:575.242
LINDSTROM, E. W. 635.67:575.242
Some new mutants in maize.
Iowa St. Coll. J. Sci. 1935 : **9** : 451–59.
The mutant dominant chlorophyll " old gold " striping (*Og*) is the first case of a viable dominant chlorophyll mutant in Maize ; it gives normal monohybrid segregation, the homozygous dominant, which is green in the seedling stages, being as vigorous as the heterozygote and only slightly less vigorous than normal. The dominant Teopod mutant (*Tp*), first reported in 1925 has recurred twice in Iowa, one of the new forms having the characteristic Teopod glumes over the entire ear, the other only on the lower third. The same single basic dominant gene is concerned in each case however, and it is located on the 7th chromosome between *Ra* and *Ij*. In crosses with normal lines a heterozygous Teopod plant gives an excess of normals, indicating reduced viability of Teopod plants. Another dominant mutation the author has discovered causes the production of a sorghum-like tassel with numerous kernels slightly smaller than sorghum seeds. Though its

linkage relations have not been studied it differs phenotypically from other dominant tassel-seed or tassel-ear forms and is considered to be another " sex " gene. It also causes a reduction in viability, and like Teopod is not fertile in the homozygous dominant condition. The fourth dominant mutation reported was a bud mutation involving a change from recessive *Pwr* (colourless pericarp, red cob) to the dominant *Prr* (red pericarp, red cob).
Four new recessive mutations are also reported. The first is another anthocyanin gene (a_3) similar to the dominant sun red (*ABpl*) and located on the tenth chromosome 23 units beyond C_7, on the other side from *R*. A new albino seedling gene (W_4) lethal when homozygous, is located on the fourth chromosome about 39 units from *su* " Albescent " chlorophyll (*al*) does not affect the seedling stage, but causes white streaks on older leaves, the plant taking on a silvery appearance ; it probably belongs to the *Y* linkage group. The last mutation reported is a case of a yellow dent corn mutating from starchy to sugary (*Su* to *su*), interesting in that it shews that sweet corn may have a relatively recent origin.

535. STADLER, L. J. 633.15:575.243:576.312.36
Loss mutations in maize.
Iowa St. Coll. J. Sci. 1935 : **9** : p. 427.
Evidence is presented that in many cases apparent gene mutations induced by X-rays are short chromosome deficiencies without lethal effect on the gametophyte (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 83). Deficiencies large enough to be visible at pachytene have been found which in some cases are transmitted through the female gametophyte and partially through the male ; such deficiencies form intermediate steps between the larger ones lethal in the gametophyte and the smaller ones which resemble gene mutations in their behaviour.
A method for the demonstration of deficiencies too short for cytological demonstration is described, involving the production of shorter deficiencies from haplo-viable visible deficiencies by crossing over in regions of non-homologous pairing, such as has been shewn to occur in the case of a deficiency in chromosome 5.

536. DICUS, A. L. 633.15:575.42:575.12
How smoky Dent corn was improved.
Seed World 1935 : **38**(4) : p. 26.
A brief popular account of the method of production of the present Smoky Dent by growing mixed seed of the Old Smoky Dent and a variety August Red obtained from Columbus, Ohio. The main points on which selection is carried out are enumerated ; these include high oil and protein content. By selection the height of the ear has been reduced from 60–65 to 49 inches and now quite a number of the stalks produce two cobs. The time of maturity has been shortened from 85–90 days to 72–75.

537. 633.15:576.312.35:576.354.4
HUMPHREY, L. M. 635.67:576.312.35:576.354.4
Chromosome studies in Black Mexican maize I. Behaviour of extra chromosomes in Black Mexican inbreds and hybrids with dent types of maize.
Iowa St. Coll. J. Sci. 1935 : **9** : 549–57.
Extra chromosomes were found in 10 inbred lines of Black Mexican sweet corn and in seven out of eight hybrids with inbred lines of dent corn. Somatic chromosome numbers ranged from 20 to 30 and at meiosis in different lines and hybrids, 10 to 14 bivalents (as well as 10_{II} and 1_I and 11_{II} and 1_I) were found, though according to the author's table the number of bivalents was not always half the number of somatic chromosomes.
The behaviour of the extra chromosomes at meiosis is described and shewed certain irregularities, such as precocious contraction of univalents, loose association of extra chromosomes in pairs which sometimes broke down into univalents before metaphase I. Multivalent associations were never found, nor were there any micronuclei. The second division was regular and normal pollen grains were formed.

The extra chromosomes clearly cause no reduction in vigour, or they would not have survived nine generations of selection and inbreeding, and the fact that all Black Mexican lines examined carry them suggests the possibility that they are connected with the characters of this variety. The author suggests that extra chromosomes with similar properties may have been responsible for changes in chromosome number of evolutionary importance.

538. Beadle, G. W. 633.15:576.354.4:575.113
Inherited abnormalities of meiosis in *Zea Mays*.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 36–37.

Genes are known in maize causing asynapsis, failure of cytokinesis at meiosis, supernumerary meiosis-like divisions in the pollen, attenuation of anaphase chromosomes and " sticky " chromosomes.

The sticky chromosome gene causes clumping of chromosomes at metaphase of meiosis and fragmentation at anaphase, with similar but less pronounced anomalies in somatic mitosis. It also results in frequent chromosome elimination, translocation and mutation.

539. Clarke, A. E. and Anderson, E. G. 633.15:576.356.2:581.162.5
A chromosomal interchange in maize without ring formation.
Amer. J. Bot. 1935 : **22** : 711–16.

A number of selfed progenies from a culture of maize subjected to X-ray treatment gave partially sterile plants which when cytologically examined shewed no chromosome rings at meiosis but either ten separate pairs of chromosomes or more rarely eight pairs and a chain of four.

A more detailed examination of pachytene figures shewed that there is an interchange between the satellite chromosome and the third longest chromosome which carried the a–ts_4 linkage group, involving the satellite itself and about 25 per cent of the short arm of the a–ts_4 chromosome. There was no synapsis between the normal and interchanged terminal chromomeres and in many cases none between the end portions of the a–ts_4 chromosome, which explains the types of configuration found.

Three types of pollen were observed, normal pollen grains, grains partly or entirely filled with starch but smaller than normal and sterile grains with no starch.

540. Akemine, T. 633.15:577.8
(On the sex expression of *Zea mays*).
Jap. J. Genet. 1935 : **11** : 248–52.

This paper deals with the different genes regulating the various forms of sex expression in *Zea mays* such as andromonoecism, gynomonoecism, hermaphroditism, maleness, femaleness, and asexuality.

An account is also given of the work of Jones and Emerson on the production of ♂ and ♀ maize plants.

541. 633.15:581.162.3:581.331.23
Brieger, F. G. 633.71:581.162.3:581.331.23
Self- and cross-pollination in *Zea mays* and *Nicotiana tabacum*.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 51–53.

Genetical experiments shewed that when different lines of maize are interplanted and free pollination is allowed, there was a pronounced tendency for intra-line rather than inter-line pollination to occur. This is attributed to pollen tube competition.

In *Nicotiana Tabacum* " Cuba " pollination with a mixture of " Cuba " and " *macrophylla* " or " *petiolaris* " pollen shewed competition in which " Cuba " pollen tubes were less successful. Thus in both *Nicotiana* and *Zea* pollen tube competition had caused an alteration in the normal type of reproduction, from cross-pollination to inbreeding in *Zea* and vice versa in *Nicotiana*.

542. TAVČAR, A. 633.15:581.48:575.11–18
Beitrag zur Vererbung der Kornreihenanzahl an Maiskolben. (**A contribution to the inheritance of the number of rows in the maize cob.**)
Z. Zücht. 1935 : A **20** : 364–76.
By selfing for three years two plants each with two four-rowed cobs found among the progeny of an eight-rowed Indurata maize variety, homozygous four-rowed plants were obtained.
Crosses were made between the four-rowed and eight-rowed strains differing in the colour of pericarp, endosperm and cob.
Among the progeny a variation frequently appeared in the form of plants with cobs of which the top half was four-rowed and the lower half eight-rowed.
The data shew that the genetical constitution of the four-rowed type is $Rw_1Rw_1rw_2rw_2$ and of the eight-rowed, $Rw_1Rw_1Rw_2Rw_2$.
Evidence from the F_1 and back-crosses established the fact that the genes for number of rows, Rw_1 and Rw_2, were inherited independently of each other and of the genes for red pericarp, red cob and yellow endosperm.

543. 633.15:581.9:575.113
HOROVITZ, S. 633.15:576.16(8)
Distribución geográfica de factores genéticos en los maíces autóctonos del norte argentino. (**Geographical distribution of genetic factors in the aboriginal maizes of northern Argentina.**)
Rev. Argent. Agron. B. Aires 1935 : **2** : 133–35.
A study of the aboriginal maize varieties of the district has shewn that the majority of the genes are distributed in two distinct regions, one of which occurs in the Andes and the other in the Chaco plain. Examples are given of numerous gene pairs of which the one occurs exclusively in the one region and its allelomorph in the other. Thus the genes *rch*, *Pl* and *amylosaccharata* are characteristic of the Andes region and absent in the Chaco plain while *Bn*, *pr* and " amargo " (bitter) are absent in the Andes and present in the plain. The author suggests that the two regions constitute two independent centres of origin of maize and points out that they correspond to the two centres of prehistoric cultivation referred to by Vavilov and Parodi. It is probable that these regions will provide other genes, characters and forms of economic value such as drought resistance.

544. KERLE, W. D. 633.15–1.521.1(67.62)
Maize. Factors affecting the field and quality.
Planter 1935 : **3** : 14–15.
Contains practical directions for seed selection which is best carried out in the field.

545. 633.15–1.525:575.3
SPRAGUE, H. B. 633.15:581.056
The adaptation of corn to climate.
J. Amer. Soc. Agron. 1935 : **27** : 680–81.
JONES, D. F. and HUNTINGTON, E.
Further comments on adaptation of corn to climate.
J. Amer. Soc. Agron. 1935 : **27** : 682–83.
Criticizing an article by Jones and Huntington (cf. " Plant Breeding Abstracts," Vol. V, Abst. 1009) the first author brings forward figures from yield trials in New Jersey which he claims do not support their rule that " corn may be moved from a less favourable to a more favourable climatic region without loss of productive capacity and usually with distinct gain," but on the contrary support the principle that varieties grown and properly selected in a given environment normally exhibit greater adaptation to that particular complex of conditions than varieties introduced from a region with different conditions of soil, climate and pests.
The authors of the original article, replying, claim that his figures do not contradict their rule, are unfairly chosen, and certain of them are irrelevant. More figures are required comparing the yields of introduced varieties with the yields obtained in their native environment.
Results obtained with sweet corn are also mentioned to support their original findings.

546. 633.15–1.557:575.12
JENKINS, M. T. 633.15:575.14:575.42
The effect of inbreeding and of selection within inbred lines of maize upon the hybrids made after successive generations of selfing.
Iowa St. Coll. J. Sci. 1935 : **9** : 429–50.

For eight inbred generations (except the seventh) of 14 lines of Iodent and 14 of Lancaster Surecrop the yield of the top-cross on the variety Krug was measured to determine the effect of inbreeding, and corresponding measurements were made in the case of a sister progeny in each generation, chosen at random from those discarded in the course of selection during the inbreeding, to determine the effect of selection.

In comparing the selected with the discarded progenies, the differences in the top cross yields were never statistically significant except in the first and second generations of the Iodent lines, but there was a fairly constant tendency for the selected to give a higher yield than the discarded. The differences between successive generations of all lines were not significant except between the fifth and sixth generations, and this is ascribed to chance ; there was no significant increase in yield from the first to the eighth generation, and it is considered that selection has been successful only in preventing decreases in yield.

Analysis of variance demonstrated that the variance due to lines was much greater than that due to generation, and it is shewn that the lines established their individuality early and maintained it with little change throughout succeeding generations.

Data were also obtained on a number of other characters, including lodging and *Diplodia*-infected ears, factors which had been considered in selecting. There was a general tendency for selected progenies to produce more erect plants in top crosses, but they produced more *Diplodia*-infected ears than their discarded sibs. With respect to other characters, such as kernel rows per ear, plant height and so on, which had not been considered in selecting, substantially the same type of variation was found with respect to generation and line as was found in the case of yield.

To determine whether the method of selection used tended to perpetuate the more heterozygous individuals, data were taken on certain individual plants in the top cross progeny of the selected and discarded progenies and compared to see which was the more variable, but no difference could be detected.

The results on yield are discussed in relation to the present theories of quantitative characters.

The author concludes that in producing inbred lines for crossing, selection in the early generations should be concentrated on selection between lines, based on crossing tests, and it is suggested that the early stability of the lines is due to essentially equal numbers of dominant allelomorphs being preserved in inbreeding, irrespective of which particular genes are present in the dominant condition.

547. NEAL, N. P. 633.15–1.557:575.12
The decrease in yielding capacity in advanced generations of hybrid corn.
J. Amer. Soc. Agron. 1935 : **27** : 666–70.

In 10 single, 4 three-way and 10 double hybrids the yields of grain of the parental pure lines, the F_1s, F_2s and in some cases the F_3s were measured under conditions designed to minimize environmental effects. The results were then analysed to test how they fitted Wright's generalization that " a random bred stock derived from n inbred families will have $^1/_n$th less superiority over its inbred ancestry than the first cross or a random-bred stock from which the inbred families might have been derived without selection;" the F_1 corresponds to the first cross and the F_2 or F_3 to the first mentioned random bred stock.

The average actual losses of excess vigour in the F_2 were 47·6 per cent, 36·8 per cent and 25·8 per cent respectively for the single, three-way, and double hybrids, shewing a close agreement with the expected losses of 50 per cent, 33.3 per cent and 25 per cent respectively. The results for the F_3s tested were not significantly different from the F_2s.

The actual reductions in yield were 29.5 per cent, 23.4 per cent and 15.8 per cent compared with the expected 31.05 per cent, 21.03 per cent and 15.29 per cent for the single, three-way and double hybrids respectively.

The results are in general agreement with earlier work on the subject (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 987).

548. SMITH, S. N. 633.15–2.111–1.521.6:575.12
Tests with cold resistant strains of sweet corn.
Canner 1935 : **81**(7) : p. 11.
On the basis of one year's test of thirteen strains of sweet corn under field conditions certain crosses of hybrid sweet maize are regarded as likely to be resistant to cold.
Open pollinated varieties suffered heavily in frosts from about the middle of March to early in May but Early Tender-gold Bantam Hybrid gave 51 per cent germination, Golden Cross Bantam 63 per cent and Soo-bred Bantam Hybrid 81 per cent as compared with 4 per cent and 17 per cent for the open pollinated varieties Golden Bantam and Stowels Evergreen respectively.
If an early crop is desired the advantages of cold resistant types are obvious.

549. 633.15–2.183–1.521.6:575
HALL, D. M. 633.15–2.183:581.4
The relationship between certain morphological characters and lodging in corn.
Tech. Bull. Minn. Agric. Exp. Sta. 1934 : No. 103 : Pp. 31.
Analysis of variance shewed significant differences between a number of selfed lines and F_1 hybrids of maize in respect of some 14 or 15 characters which theoretically might be expected to affect the tendency to lodging and certain of these characters were found to be correlated with the amount of natural lodging.
In general, strength, i.e. resistance to lodging, is dependent on a number of independent characters and no line studied was " strong " in all the characters investigated.
The reaction of the characters was studied in the F_1 hybrids and there was a general tendency for strong x strong hybrids to be graded " stronger " in the several characters than weak x weak hybrids. This, however, was not true of all characters and moreover there was a great deal of variability.

550. 633.15–2.3–1.521.6:575.11
WELLHAUSEN, E. J. 635.67–2.3–1.521.6:575.11
Genetic investigations of bacterial wilt resistance in corn as caused by *Bacterium stewartii* (Smith) Migula.
Iowa St. Coll. J. Sci. 1935 : **9** : 539–47.
Inbred lines of field maize, white sweet maize, and early yellow sweet maize were tested for resistance to bacterial wilt *Bacterium Stewartii* (Smith) Migula. In general the majority of the lines of field maize were resistant, of white sweet maize intermediate, and of early sweet maize susceptible.
In crosses between lines of different grades of resistance or susceptibility, the F_1 always had the same reaction as the more resistant parent, shewing that resistance is dominant.
Segregation was followed in further generations in the case of two crosses between a very resistant and a very susceptible line. When resistance was tested with an attenuated culture, segregation in F_2 and back-crosses was monofactorial, but with a highly virulent culturel bifactorial segregation was obtained, shewing that there are two major dominant complementary factors for resistance, one of which reacts to an attenuated culture. The segregation in progenies of selfed plants of a back-cross also indicated the possible existence of a third, minor factor.

551. SAVULESCU, T. and RAYSS, T. 633.15–2.484–1.521.6:578.08
La résistance de différentes lignés de blé au *Nigrospora Oryzae* (B. et Br.) Petch et une méthode nouvelle pour la détermination de " l'effet parasitaire."
(**The resistance of different lines of wheat to *N. Oryzae* (B. and Br.) Petch and a new method for the determination of the " parasitic effect."**)
Proc. 6th Int Bot. Congr. Amsterdam 1935 : **2** : 208–10.
The " Index of parasitic effect," which is considered to be a valuable new measure in plant pathology, was obtained by grading on an arbitrary scale the proportion of plants infected and intensity of attack, multiplying them together, and taking the average of a number of observations at different places.
In this way the susceptibility of a number of varieties of maize to *Nigrospora Oryzae* was determined.

552. HOLBERT, J. R., FLINT, W. P., BIGGER, J. H. and DUNCAN, G. H. 633.15–2.7–1.521.6:575.12
Resistance and susceptibility of corn strains to second brood chinch bugs.
Iowa St. Coll. J. Sci. 1935 : **9** : 413–26.
The resistance to chinch bug second brood attack of certain double cross and top cross hybrids from resistant pure strains, of two resistant open-pollinated varieties as well as a double cross hybrid susceptible to the pest, was tested by growing long plots stretching right across fields of local open-pollinated susceptible varieties.
Under conditions of heavy infestation, the resistant hybrids gave the greatest yields of sound grain and were only slightly outyielded under conditions of light infestation, and it is suggested that the growing of such resistant hybrids offers the best solution to the problem of chinch bug attack..

BARLEY 633.16

553. POPE, M. N. 633.16:575.12:578.08
The production of barley seed through post-harvest pollination.
J. Hered. 1935 : **26** : 411–13.
Experiments have shewn that cut shoots of barley standing in water can be used for making crosses and will produce viable seed.

554. EULER, H. v., HELLSTRÖM, H. and LÖFGREN, N. 633.16:575.242.061.6:581.192.2
Zur chemischen Genetik chlorophyllmutierender Gerstsensippen. Vergleich zwischen dem Gehalt an Chlorophyll und Gramin in den Sippen Primus I, Primus II (Gulvit, Xanthalba und Xanthaurea) (Nilsson-Ehle), Westergaards Linie und einer Linie aus Kreuzung von Goldgerste x Chevalier (Hallqvist).
[On the chemical genetics of chlorophyll mutating barley strains. Comparison of the content of chlorophyll and gramin in the lines Primus I, Primus II (Gulvit, Xanthalba and Xanthaurea) (Nilsson-Ehle) Westergaard's line, and a line from the cross Goldgerste x Chevalier (Hallqvist).]
Hoppe-Seyl. Z. 1935 : **234** : 151–64.
The chlorophyll content of a number of chlorophyll defective mutants, all of known genetic origin, and of their normal allelomorphs was determined and the results are tabulated. The normals were all more or less alike while certain mutants contained no chlorophyll at all ; these all shewed chloroplast degeneration. An indol base $C_{11}H_{14}N_2$, named gramin, was found in certain of the lines and its chemical structure is discussed. It appeared not only in the normal but also in the chlorophyll defective lines, in which it occurred in higher proportions. It is possibly a degradation product.

555. ANDERSSON, G. 633.16–2.111–1.521.6:575.11
Auslese von winterfesten Transgressionen bei Wintergerste durch Gefrierversuche. (**The selection of winterhardy transgressive progeny of winter barley by means of freezing experiments**).
Züchter 1935 : **7** : 254–60.
Spring barley is almost exclusively grown in Sweden but the higher yield and other advantages of winter barley would make the cultivation of the latter desirable if sufficiently winter-hardy varieties could be bred. Crosses were therefore made between Mansholts Groninger, a Dutch winter barley and a Rumanian land barley which can be used for either spring or winter sowing. The parent varieties and 3,000 plants of the F_4 were subjected to a temperature of −13°C. after short treatment at + 2° and −2° which was repeated when the plants were removed from the lowest temperature. The Rumanian variety was completely destroyed and the Dutch variety too damaged for recovery but there was marked transgressive segregation among the progeny and between 3 and 4 per cent of the plants survived. After the elimination of those with unsatisfactory

characters, however, only one plant remained. From this individual a progeny was grown which was definitely more winter-hardy than Maasholt. The plants of this progeny were also tested on freezing at a temperature of —17° and again there was considerable segregation.
In order to test further the results of the method, analyses were made of the dry matter and the sugar content of the plants and the differences in sugar content were found to be in agreement with those of the cold resistance. The advantages and difficulties of the freezing method are discussed.

556. 633.16–2.42–1.521.6:575
632.42:576.16
HONECKER, L.
Weitere Mitteilungen über das Vorkommen biologischer Rassen des Gersten-Meltaues (*Erysiphe graminis hordei* Marchal), ihre Verbreitung in Deutschland und die sich daraus ergebenden Richtlinien für die Immunitätszüchtung. **[Further contributions to the existence of biological races of barley mildew (*E. graminis hordei* Marchal), their distribution in Germany and the resultant guiding lines for immunity breeding].**
Züchter 1935 : **7** : 113–19.
Further investigation on the existence of biological races of barley mildew and their reaction on the standard varieties included 63 tests from 32 localities. Besides the already known forms A and B (cf. " Plant Breeding Abstracts," Vol. V, Abst. 369) the existence of a new form C is established. The results shewed that Form A is most widely distributed throughout Germany and also shews the least virulence. Forms B and C are both more virulent.
The production of a malting barley that is immune to both A and B presents a difficult problem as it involves crossing between the resistant Dalmatian variety Ragusa, which belongs to the systematic group *H. vulgare* and four-rowed barleys which possess the qualities desired in a malting barley. As a rule repeated back-crossing of the immune two-rowed progeny with fine malting barleys is successful.
As the organism passes the winter in the conidial form on winter barleys, a resistant winter barley should reduce the frequency and degree of the mildew epidemic. With this aim in view selection of a suitable four-rowed winter barley from the Dalmatian variety Ragusa that shall be immune to A and B and fairly resistant to C, has been begun.
Certain spring varieties such as Nigrate C. J. No 2444 and Gopal C.J. No. 1091 both from the University of Michigan are, if not immune, at least highly resistant to all three races and are suitable parents for breeding for higher resistance in spring varieties.

557. 633.16–2.42–1.521.6:575.116.1
BRIGGS, F. N.
Inheritance of resistance to mildew, *Erysiphe graminis hordei*, in a cross between Hanna and Atlas barley.
J. Agric. Res. 1935 : **51** : 245–50.
Segregation for resistance in the F_2 of a cross between Hanna and Atlas barley varieties shewed that the susceptibility of Atlas was due to a single pair of Mendelian factors which gave incomplete dominance in heterozygous hybrids ; this was confirmed by the F_3 segregation.
At the same time was studied the segregation in F_2 of the characters six-rowed versus non-six-rowed spikes and short-haired versus long-haired rachilla which are allelomorphic pairs belonging to linkage groups 1 and 2 respectively. No linkage was found between resistance to mildew and either of these character pairs.
Further crosses are being made in an effort to determine the linkage group to which the disease-resistant factor belongs.

558. 633.16–2.452–1.521.6
STRAIB, W.
Ueber Gelbrostanfälligkeit und -Resistenz der Gerstenarten. (**On yellow rust susceptibility and resistance of barley species.**)
Arb. biol. Reich. Land- u. Forstw. Berl. 1935 : **21** : 467–81.
Greenhouse tests were made of the reaction of 27 winter and 158 spring varieties of barley belonging to the species *Hordeum hexastichum, H. vulgare* and *H. distichum* to 13 races of yellow

rust (*Puccinia glumarum* [Schm.] Erikss. et Henn.), obtained from various countries and of known characteristics as regards their infection capacity on wheat.
Very few of the barleys proved resistant to the two recently isolated yellow rust races Nos. 23 and 24 but on the other hand most of the varieties of barley tested were either slightly susceptible, predominantly immune or highly resistant to all the other races of yellow rust.
Susceptibility and resistance occurred more or less equally within all three barley species.
One variety of barley in the *H. vulgare pallidum* species proved immune to 25 races of yellow rust and three German varieties, Ackermann's Bavaria, Heils Franken and Heines Hanna, were resistant to race 23 as well as being immune to all " wheat " rust races.

559. 633.16:663.421(49.7)
TAVČAR, A. 633.16:575.42
Escourgeon (orge d'hiver) deux rangs comme orge de brassage. (**Two-rowed winter barley as a malting barley.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial Yougoslavie. Sect.IV: Thème No. 2 : Pp. 7.
Trials of two-rowed summer barleys having given unsatisfactory results in respect of malting value, Tschermak's two-rowed winter barley (see " Plant Breeding Abstracts, Vol. III, Abst. 221) was tried. This variety gave eminently satisfactory results, both in quantity of yield and quality of the product for malting, and malting and brewing tests also shewed it to be of great value.
The author also has selected from it certain lines with green glumes and greater precocity.

RICE 633.18

560. 633.18 Agostano
SAMPIETRO, G. 633.18 Agostano :575(45)
Nuove sementi. Agostano. (**New rices. Agostano.**)
G. Risicolt. 1935 : **25** : 97–101.
Derived from the cross Nano x Chinese Ostiglia, the new hybrid Agostano is as early or earlier than Nano and has the high yield and resistance to lodging of Chinese Ostiglia. It is besides not exacting and germinates readily.

561. 633.18 Greggio
SAMPIETRO, G. 633.18 Greggio :576(45)
Nuove sementi. Greggio. (**New rices. Greggio.**)
G. Risicolt. 1935 : **25** : 193–96.
A description of the new variety Greggio from a cross between Lady Wright and Nano, made in the hope, which was only partially fulfilled, of combining the dwarf growth of the one with the fine grains of the other.

562. 633.18:575.42(92.2)
WULFF, A. 633.18.00.14:578.08(92.2)
De rijstproductie van Nederlandsch-Indië en het rijstvariëteiten-vraagstuk. (**Rice production in the Dutch Indies and the problem of rice varieties.**)
Landbouw 1935 : **10** : 375–97.
Article already reviewed from another source (Cf. Abst. 563 below).

563. 633.18:575.42(92.2)
WULFF, A. 633.18.00.14:578.08(92.2)
De rijstproductie van Nederlandsch-Indië en het rijstvariëteiten-vraagstuk. (**Rice production in the Dutch Indies and the problem of rice varieties.**)
Landbouwk. Tijdschr. Wageningen 1935 : **47** : 223–40.
An important problem in Java and Madoera and other parts of the Netherlands Indies is the promotion of rice cultivation. Increased yields are needed and more productive varieties should

be grown. But in replacing old varieties by new ones numerous factors such as flavour, disease and drought resistance must be considered as well.
A full description of the methods used in the selection plots at Buitenzorg and other districts in the collection of varieties for testing, and the procedure followed in the trial is given with a note on the bloc method of testing which has been introduced in the observation plots and is regarded as promising.
The need for improving the quality of the rice produced in Java and Madoera is pointed out and a reduction in the number of varieties grown combined with systematic selection for the desired qualities is recommended.
The importance of distributing to growers only good pure seed of selected varieties is emphasized and the method of multiplication of a new variety is illustrated.

564. 633.18:576.356.5:576.356.4
633.18:576.312.35
SAKAI, K.
(Chromosome studies in *Oryza sativa* L. I. The secondary association of the meiotic chromosomes.)
Jap. J. Genet. 1935 : **11** : 145–56.
From a series of observations on meiosis in *O. sativa* L., 5 is regarded as the primary basic number from which 12, the usually accepted number has been derived.
Quadrivalent association at diakinesis and metaphase I was observed in normal diploids. Also secondary association of the chromosomes at meiosis was very clearly marked, the maximum association being two groups of three and three groups of two. These findings and evidence from other workers have led the author to conclude that *O. sativa* L. belongs to the secondary polyploids and is a doubly hexasomic tetraploid.

565. MATSUSHIMA, K. 633.18:576.356.5:581.036
(Chromosome doubling in the rice plants treated with high temperature.)
Jap. J. Genet. 1935 : **11** : 235–37.
Rice plants of the lowland variety Asahi on being subjected to a temperature of 42°C. and over shewed numerous cells containing at metaphase 48 chromosomes in root tips, i.e. twice the normal number. On the whole the cells in which doubling occurred were larger than ordinary ones, but the chromosomes were indistinguishable in size and shape from those of normal cells. No association of the chromosomes was observed.

566. PIACCO, R. 633.18:581.162.3
Casmogamia e cleistogamia nel riso (*O. sativa* L.). **[Chasmogamy and cleistogamy in rice (*O. sativa* L.).]**
G. Risicolt. 1935 : **25** : 180–90.
An account of anthesis in the rice flower which makes it clear that chasmogamy is the rule and that Farneti was in error when he described the rice flower as cleistogamous.

567. IMAI, Y. 633.18–2.191:575.243
Chlorophyll deficiencies in *Oryza sativa* induced by X-rays.
Jap. J. Genet. 1935 : **11** : 157–61.
A brief account of existing knowledge on chlorophyll deficiencies, regarded as genic and plastid mutations, in *O. sativa* precedes the report on the author's experiments on the effects of X-ray treatment on a pure line of Mubô-Aikoku, a strain of which 1215 untreated pedigrees shewed a mutation frequency of 0·08 per cent. X-ray treatment when given at microsporogenesis had more effect on the mutation rate than at flowering time.
Irradiation resulted in a mutation rate of 1·14 per cent, i.e. 14 times that of the untreated series.

568. 633.367:576.312.32
TUSCHNJAKOWA, M. 633.367:575.127.2:576.356
Über die Chromosomen einiger Lupinus-Arten. (**On the chromosomes of some species of lupins.**)
Züchter 1935 : **7** : 169–74.

The objects of this investigation were to arrive at a criterion for the formulation of a classification of the genus *Lupinus* and to ascertain the cause of failure in crosses between species of lupins.
The cytological approach to the problem of species crosses offers a possible way of obtaining types with non-splitting pods. The success of such crosses between near or distantly related forms depends on similarity or dissimilarity of the chromosome numbers of the two species involved.
In examining the material difficulty was found in counting the chromosomes owing to their length, thinness and complicated intertwining. This was overcome by cooling the preparations for 6 hours and thereby reducing the length of the chromosomes.
About 20 European and American species were examined and the majority shewed 2n = 48. One, *L. subcarnosus*, had 36 which suggests that the basic number might be 6 or 12 and not 8 or 4 as has been supposed ; but no definite conclusion can be reached with such a small percentage of the existing 200 species. Irregularities in the reduction division of certain American species, e.g. *L. elegans* and *L. ornatus*, are suggestive of hybrid origin. The European species represent another polyploid series with basic number 10 which includes *L. angustifolius* (40) and *L. albus* (50).
Other workers' views on the possible causes of failures of distant crosses are mentioned and Goldmacher's method of style grafts is recommended in cases where differences in plasma constitution of the two species cause the pollen tubes to burst in the style.
L. pilosus is regarded as a hybrid in view of certain cytological irregularities and the wide range in pollen size, the great variation in the habit of the plant and its marked size, productivity, etc. Its valuable characteristics, such as large seeds, a not excessive alkaloid content and pods that do not split, all make this species worthy of the plant breeder's attention.

569. FISCHER, A. and SENGBUSCH, R. v. 633.367:581.5:576.16
Die Heimatgebiete von *Lupinus albus*, *Lup. luteus* und *Lup. angustifolius*. Die Beziehung der Wildlupinen-Standorte zum geologischen Bau des Untergrundes. Die Bedeutung der Wilderformen für die Züchtung. (**The home of *L. albus*, *L. luteus* and *L. angustifolius*. The relation of local sites of wild lupin to the geological structure of the sub-soil. The importance of wild forms in breeding.**)
Züchter 1935 : **7** : 174–82.

The greater part of this paper (which is based on data and herbarium material supplied by biologists and geographers) contains an ecological survey of the localities round the Mediterranean where wild populations of the three species in question are to be found, with special reference to the geological constitution of the soils in each region. It is still a moot point whether Abyssinia is the original home of *L. albus*. An expedition to the Mediterranean countries is contemplated to collect specimens and to investigate the forms that may be found. It is expected that in endemic races quite distinct types from the normal lupin may exist in geographically isolated regions. Such forms should be specially valuable as breeding material from which the ideal lupin meeting all modern requirements might be obtained.

570. FISCHER, A. and SENGBUSCH, R. v. 633.367:581.9(43)
Geschichte des Lupinenanbaus und die Verbreitung der Lupinen in Deutschland, sowie die Möglichkeiten der Erweiterung des Lupinenanbaus. (**History of lupin cultivation and the distribution of lupins in Germany and the possibility of developing their cultivation.**)
Züchter 1935 : **7** : 182–87, 206–07.

The development of the cultivation and breeding of the three species of lupins *Lupinus luteus*,

L. augustifolius and *L. albus* in Germany is outlined from the historical standpoint with special emphasis on the importance of the sweet lupin as a fodder plant and of the problem, still unsolved, of breeding sweet lupins with pods that do not split when mature.
The possibility of increasing the area under lupins both for seed and as a green fodder plant is discussed with special reference to the soil constitution in various regions of Germany.

571. RAABE, A. and SENGBUSCH, R. v. 633.367–2.42–1.521.6:575
Züchterisch wichtige Beobachtungen an einigen Lupinenarten. Die Empfindlichkeit von *Lupinus luteus, Lupinus augustifolius, Lupinus albus* und *Lupinus mutabilis* gegen Frost und Kalk und ihre Anfälligkeit gegen Meltau und Welke. (**Observations of genetic importance on some lupin species. The sensitivity of *L. Luteus, L. angustifolius, L. albus* and *L. mutabilis* to frost and lime and their susceptibility to mildew and wilt.**)
Züchter 1935 : **7** : 244–48.
Sown in the open the four species named shewed clear differences in their reaction to the winter of 1934–35 in which a temperature of —6 to —7°C. was recorded in November. *L. angustifolius* shewed no injury, *L. luteus* only very little, *L. albus* more and *L. mutabilis* was completely frozen and died after thawing had set in. A comparison of these results with others obtained with *L. angustifolius* in 1932–33 leads to the conclusion that lupins are not resistant to very heavy frost but with lighter frosts it is the soil that freezes while the plants merely wither and die off probably only owing to lack of water.
Similarly specific differences were found in sensitivity to calcium, *L. angustifolius* being least sensitive, and *L. mutabilis* the most so. The injury is not due to reduced germination capacity and a method of selection for less sensitive forms should be evolved by the breeder.
As regards mildew infection *L. mutabilis* proved much less susceptible to the general infection of 1934 than the other species. The reason for this relatively low degree of infection is thought to be due not to the morphological features of the plant but to some physiological or other causes.
From the examination of the roots of the four species of lupins, from the symptoms in sick plants and from seedling inoculation experiments with *Thielavia basicola* and *Rhizoctonia solani* it is concluded that wilt in lupins is not due to these two organisms though they are frequently found on lupins suffering from the disease. Reference is made to the diagnosis of the virus origin of wilt in New Zealand.
A table summarizing the foregoing data for the four varieties and shewing their respective times of ripening, chemical composition and the behaviour of their pods as regards splitting shews the material available for genetic research either on the lines of selection and hybridization, induced mutation or interspecific crosses.

ROOTS AND TUBERS 633.4

572. 633.42:581.162.3
635.34:581.162.3
633.42:575.11
ROEMER, W. 635.34:575.11
Fruchtbarkeits– und Vererbungsstudien bei *Brassica*-Artkreuzungen. (**Studies on fertility and inheritance in species crosses in *Brassica*.**)
Z. Zücht. 1935 : A **20** : 377-416.
Details are given of the results of crosses made between *Brassica Napus rapifera* x *B. oleracea* sub. var. *acephala, capitata, gongylodes, gemifera, sabauda*, marrow stem kale, wild cabbage from Heligoland, colza and turnip rape.
On the whole, the crosses in which *B. Napus rapifera* was used as the female parent set seed but the reciprocal crosses with *B. oleracea* set no seed. That is, the crosses were only successful when the female parent had the higher chromosome number, though there were considerable differences in fertility. The fertility of the individual crosses was no indication of the fertility of the F_1 in crosses *inter se* or in back-crosses with the parents.

The investigations on inheritance included characters for growth habit, head formation, shape and colour of leaves, root development and flesh colour. In all crosses of *B. Napus rapifera* with the forms of *B. oleracea* the F_1 markedly resembled *B. Napus*. All the F_1 plants shewed a turnip-like development of the root, which is possibly why doubt is thrown on the success of such crosses, but the segregation in F_2 and the variation in the leaf shape is proof of the effectiveness of the cross.

573. DAVIDSON, W. D. 633.491(43)
History of potato varieties.
J. Dep. Agric. Irish Free St. 1935 : **33** : 57–81.
A historical survey of a large number of English, Irish and Scottish potato varieties. Records from 1730 to about 1917 are quoted from a variety of sources. The origins of the different varieties are given where possible.

574. 633.491:575(73)
HAGAR, W. S. and JOHNSON, G. F. 633.491 Mercer
History of the Mercer potato.
Pa. Dep. Agric. 1935 : Pp. 12. (Mimeographed.)
An account of the origin and subsequent spread of the Mercer potato, which was not only the first popular potato variety in the United States but was the most widely grown variety in that country in the first half of the nineteenth century, that is until the advent of blight (*Phytophthora infestans*).
The variety was developed by John Gilkey of Mercer County (now part of Lawrence County Pennsylvania), by growing the true seed from potato berries in 1800 or 1801. It rapidly spread and its popularity with consumers was in a large measure responsible for the recognition of potatoes as a farm crop in the United States. The last report of its being grown was in 1869 in Maine.

575. MÜLLER, K. O. 633.491:575.127.2:575
Über Artkreuzungen bei der Kartoffel und ihre Bedeutung für die praktische Kartoffelzüchtung. (**Species crosses in the potato and their importance for practical potato breeding.**)
Angew. Bot. 1935 : **17** : 253–65.
A brief account is given of the recent Russian work on the systematics of the potato, from which, *inter alia*, it is concluded that *Solanum andigenum* has probably participated in the origin of the European cultivated potato, which is more diverse than the *S. tuberosum* occurring in South America ; the forms originating from Daber are quoted in this connexion, many of them having certain characters clearly reminiscent of *S. andigenum*.
The importance of choice of parent is exemplified both by the Russian work and the author's own crosses, where for instance *S. demissum* only set seed in crosses with European varieties when it was used as maternal parent. The reciprocal cross has recently been effected, though only with the W races of *S. tuberosum*.
The various problems that are expected to be solved by the use of interspecific crossing in the potato are briefly discussed : first among these is the production of blight-resistant forms, in which connexion it is pointed out that the Ef. strains from which the author's W strains were obtained were apparently not pure *S. tuberosum* but complicated 48 chromosome hybrids of some primitive forms from the central part of the South American continent. These are not resistant to the new strain of *Phytophthora*, to which only certain varieties even of *S. demissum* are resistant. These are now being used as parents, with repeated back-crossing with *S. tuberosum*, only those plants that survive under artificial infection being retained in each generation. The choice of parental varieties of *S. tuberosum* is an important factor in success.
In breeding for cold resistance the chief attention is given to *S. acaule*. Although this has not been crossed with *S. tuberosum*, successful crosses of it have been made with other South American wild and cultivated species and by this means its frost-resistance may be transferred to the cultivated potato.
Drought resistance and virus resistance are other problems likely to be solved by interspecific

crossing. Some of the hybrids of the SW races shew marked resistance or tolerance to mosaic, stripe and curl. In spite of the usual dominance of the short-day reaction of *S. andigenum* in crosses with *S. tuberosum* it is probable that in later generations of these crosses gene combinations will arise which surpass both parents in yield : the unusually high yields of some of the W races may be an example of this effect.
The new South American species have much more importance for the subtropical portions of the Soviet Union and other short-day countries than for northern European countries.

576. STAPP, C. 633.491–2.3–1.521.6:575
Beitrag zur Frage der Widerstandsfähigkeit verschiedener Kartoffelsorten gegen Schwarzbeinigkeit und Knollennassfäule, verursacht durch *Bacillus phytophthorus* App. (**On the question of the resistance of different varieties of potatoes to blackleg and tuber wet rot caused by *B. phytophthorus* App.**)
Angew. Bot. 1935 : **17** : 97–117.
After a review of the findings of previous workers an account is given of field tests carried out at Dahlem from 1928–1932 with 30 varieties of potatoes subjected to artificial infection with two highly virulent strains of *B. phytophthorus* App.
Two varieties " Alte Daber " (a medium late white potato) and Flora (a medium early, yellow type) proved highly resistant ; five varieties were only slightly susceptible, nine highly susceptible and eight very highly susceptible.
No definite conclusions could be reached about the existence of correlations between resistance and thickness of skin, capacity for periderm formation after wounding, rapidity of decomposition, time of maturity or flesh colour ; nevertheless it was noted that among the more resistant varieties late forms predominated and 7 out of 8 very highly susceptible groups had yellow flesh.

577. 633.491–2.41–1.521.6:575(75)
633.491–2.8–1.521.6:575(73)
STUART, W. 633.491:575(73)
Development of new varieties of potatoes.
Proc. 20th Ann. Meet. Ohio Veg. Grow. Ass. 1935 : 61–66.
Potato breeding by the United States Department of Agriculture has as its primary object the development of varieties resistant to late blight (*Phytophthora infestans*) but the production of virus resistant varieties has also received a great deal of attention.
A brief account is given of the methods of breeding. About half a million seedlings have been grown, from which only three named varieties have been produced, two of which, Kathadin and Chippewa, are resistant to the mosaic diseases and have tubers of a very high quality ; the third variety Golden, is notable for its heavy yield and high quality. So far, no commercially valuable blight-resistant variety has been produced.
The characteristics of a number of other new potato varieties are also reviewed.

578. YARNELL, S. H. 633.491–2.8–1.521.6:575
Influence of heredity with respect to a fruit defect of the tomato.
Gartenbauwiss. 1934 : **8** : 616–33.
The defect in question is termed puffing and is due to mal-development or marked under-development of the placental tissue, sometimes combined in the latter case with hardening of the locular walls. Affected fruits are partly hollow. Puffing is not due to a virus or other pathogen.
During 1931–1933 numbers of varieties and strains were tested for the defect and shewed fairly consistent differences in spite of environmental influences to which puffing readily responds. All strains of Albino and Marglobe and some strains of Globe and Stone shewed a relatively high percentage of puffing, while John Baer, Acme and certain strains of Bonny Best, Earliana, etc. were relatively free.

The results of experiments in selection for high and low amounts of puff and data obtained from progenies from Earliana and Globe indicated that the puff character was in all probability genetically conditioned. Varieties, certain strains of the older varieties and a number of individuals within such strains are thought to differ genetically as regards the factors affecting the amount of puffing. The possibility of developing puff-free strains is considered.
Data from two crosses of Stone x Gulf State Market and one reciprocal cross suggested that factors tending to produce freedom from puffing are dominant.
A bibliography is appended.

FIBRES 633.5

579. PEARSE, N. S. 633.51:575:677.21
Qualities in cotton required by the spinner.
Text. Wkly. 1935 : **15**(377) : p. 555.
A discussion of the types of cotton required by the cotton spinners, on the basis of which indications are given to growers and breeders as to which types they should aim at producing.

580. 633.51:575.11
KOKUEV, V. I. 633.51:677.21:575.11
(Inheritance of certain agronomic and morphological characters in cotton).
Sredaz NIHI, Tashkent 1935 : Pp. 80.
The Mendelian ratios expected from crosses involving varying numbers of factor differences are illustrated with reference to cotton, leading to the conclusion that the only successful way to use hybridization in the production of new varieties is to limit the number of parental combinations to the minimum whilst growing the largest possible number of families of each. In the case of crosses differing in a large number of characters the method of back-crossing is also recommended in order to reduce the number of types segregating.
An examination of the main commercial varieties from the point of view of the individual characters making for quality, namely ginning percentage, lint length, earliness and also size of boll shews that most of them are intermediate in respect of all these characters, each of which could if necessary be increased.
In the present investigations the different characters were considered separately. As regards size of boll, different varieties and strains varied in the proportions of three, four and five bolls they bear ; the lines with the greatest number of 5-lock bolls did not however possess the largest bolls. The weight of the lock bears a direct relation to the size of the boll, being itself constituted from the number of seeds, their size, and the weight of lint on them,
The size of bolls was studied in a cross between two American cottons, Schroeder (small bolls 3–3.5 g. in weight) and Triumph Navrotskii (large, 8–9 g.). The F_1 was intermediate, though tending more towards the larger parent, with a boll wieght of 6.5 g. An F_2 of over 3,000 individuals was grown and contained all types from the largest to the smallest, the distribution being in the form of a regular unimodal curve. The F_3 shewed several of the intermediate forms to be homozygous. The experiment thus shews that boll size is dependent on a number of factors and that desired tyes can be obtained among the segregates only by growing at least two to three thousand F_2 seedlings.
The Schroeder parent was considerably earlier in maturity than the other but some of the homozygous F_4 families combined an earliness almost equal to Schroeder with a much greater boll size, which exceeded Schroeder by up to 2.2 g., producing a difference of up to 22 per cent in yield. There seems to be no obstacle therefore to the production of early maturing cottons with higher yield.
In crosses between the local cottons (*Gossypium herbaceum*) the F_1 was generally intermediate in boll size, with occasional dominance of small boll in this case which was never observed in the American crosses. Similar polymeric segregation occurred in the F_2, though again with a tendency towards the dominance of small bolls in certain combinations. Thus a cross was made between the smallest form obtainable, line 407 with a boll weight of 3.5 g., and an Afghan form with bolls of 5 g. The F_1 was intermediate and the F_2, consisting of 194 plants, contained two groups,

102 plants all small, like line 407, and 92 plants intermediate in boll size. No form with large bolls was obtained, certain other combinations however shewed an increase in boll size both in the F_1 and F_2, these being the cases when one parent contributed large number of locks per boll and the other parent large weight of seed per lock. Thus the cross between line 3280, with bolls of 4.1 g. and line 3155 of 5.49 g. gave an F_1 with bolls of 5.8 g., whilst 3280, crossed by line 2519 (with bolls weighing 3.7 g.) gave an F_1 with bolls of 5.1 g

Observations were made on the various factors making up ginning percentage, namely weight and number of fibres and weight of seed. Great variation was observed between different cottons : the number of fibres per seed calculated in seven varieties of American cotton for instance varied from 7.8 to 14.7 thousand, and in the two varieties of *G. herbaceum* from 3.6 to 9.2 thousand ; the weight of a thousand fibres in American cottons varied from 4.4 mg. to 7.6 mg. and in *G. herbaceum* from 3.4 to 5.8 mg.; the seed weight varied from 97.0 to 167.2 mg. in American and from 69.7 to 111.8 mg. in the local cottons. Variations were observed in the way in which the ginning percentage is made up, some varieties having a small number of fibres but of a high individual fibre weight, others with a large number of light fibres. Crosses were made between these two types in the attempt to combine the characters fibre number and fibre weight. In the F_2 of such a cross between two *G. herbaceum* lines there appeared plants with a lower ginning percentage than the parents, and in others the ginning percentage was the same but differently constituted, whilst a third group constituted the desired combination of number and weight of fibres and had a ginning percentage higher than the better parent by an amount varying from 7 to 13 per cent. Lines homozygous for this combination were obtained, an F_4 line constant for a ginning percentage of 8 per cent more than the better parent being quoted. The same effect was observed in similar crosses of American cottons : a cross between Triumph, having a ginning percentage of 34–35 per cent, and a Transvaal cotton ginning 4–5 per cent gave hybrids in the F_2 ginning 40, 41 and 42 per cent and almost constant lines ginning 39.1 per cent in F_4, with every indication of giving constancy in the F_5 or F_6.

A line of *G. hirsutum*, No. 253 with petal spots, was crossed with others without petal spot. The F_1 plants all had spots but of less intense colour than the parent. The F_2 contained 585 plants with petal spot and 201 without, indicating a monohybrid inheritance for the presence of the spot, which was confirmed by back-crosses. Its intensity however shewed a wide range of variation. The behaviour in the crosses with other spotless varieties was exactly similar, and in three crosses in *G. herbaceum* the same monohybrid ratios for petal spot were obtained.

Pollen colour was studied in crosses within *G. hirsutum* and the yellow pollen colour of line 2107 proved dominant in crosses with four different varieties with white pollen, giving monohybrid ratios in the F_2. In crosses between American cottons with yellow corolla and varieties with cream or white corolla the yellow colour was dominant or partially dominant, with monohybrid segregation in the F_2. The behaviour in crosses in *G. herbaceum* was exactly similar.

The boll type in *G. herbaceum* is much more variable than in the other species. The closed boll, a type desired for purposes of mechanical harvesting, proved to be a simple recessive to the open or semi-open type.

Anthocyanin pigmentation in the plant and sometimes the flowers gave simple 1 : 2 : 1 ratios in F_2. Similar 1 : 2 : 1 ratios were obtained in crosses between forms with brown and white lint in American cottons. The intermediate forms appearing in the F_2 varied in shade but all segregated in later generations and gave 1 : 1 ratios in back-crosses ; the variations in shade are possibly due to modifying factors. Crosses in *S. herbaceum* on the other hand shewed lint colour to be dependent on two or three factors. No homozygous lines of intermediate coloration were obtained in the F_3 of the dihybrid crosses, though this is probably due to the insufficiently large size of the populations studied.

581. HUTCHINSON, J. B. 633.51:575.11.061.1

Some observations on the inheritance of form and size in Asiatic cottons.

Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 120–21.

The genetic factors affecting leaf shape have little effect on leaf length, but mainly affect growth at right angles to the main leaf veins, the control being very local, possibly confined to the individual cell. Narrow and laciniated leaf are apparently recently acquired characters in cotton.

G. herbaceum and *G. arboreum* are distinguished from one another by factors affecting shape of leaf lobes, small in individual effect, inherited quantitatively, and affecting all foliar organs. In general leaf form depends on factors with a local effect as regards differences within species, and on factors with wide influence on the form of foliar organs as regards differences between species. Three main characters determine plant habit viz. the node at which the first sympodial branch appears, the proportion of monopodial buds below that point which develop into branches and the length of the monopodial branches. In any species there is a series of types differing in these characters, but with a balance between them, and this balance is maintained in crosses within a species, but not in crosses between species, in which case a complete range of all combinations of the three components appears in F_2.
Node number was found to be associated with three simple factors, but there are indications that many more factors are operating.

582. KAPPERT, H. 633.52:575.114
Über den Rezessivenausfall in den Kreuzungen gewisser blau- und weissblühender Leinsippen. II. (**On the deficiency of recessives in crosses between certain blue and white flowered strains of flax. II.**)
Z. indukt. Abstamm.- u. VererbLehre 1935 : **70** : 73–95.
The earlier work of the author (published in 1929) and of other workers has shewn that there is a marked deficiency of the white-flowered recessive type in the F_2 of crosses between certain blue and white flowered strains of *Linum*. Investigations on crosses between the white-flowered "Stockholm" with the blue-flowered "Weimar" confirmed the previous findings, only 19.3 per cent of white plants being obtained and further, the fact was established that in crosses of Stockholm with another blue flowered strain no deficiency of the white genotypes occurred. In the F_2 there is a deficiency not only of the homozygous recessives but also of the heterozygous blue types. The total deficiency of the F_2 was further increased in several crosses by a deficiency in the number of seeds per capsule of the blue heterozygous plants.
Back-crosses with the recessive parent shewed that the egg cells were responsible for the deficiency and as empty seeds were rare, the possibility of unequal competition in the developing cells of the embryo sac was investigated.
It was found that of the several archesporial cells present in *Linum* all started development though only one, probably because of its genetical constitution, finally completed development.
An investigation of the inheritance of deficiency shewed that in heterozygous F_2 plants there was definite variation in the number of recessives in their F_3 progeny and these variations were genetically conditioned.
The characteristic increase in the F_3 and F_4 of the total deficiency of the recessives is explained by the presence of one or more dominant factors causing the disturbance, these being independent of the genes for colour.

SUGAR PLANTS 633.6

583. M(ANGELSDORF), A. J. 633.61:575(96.9)
Variety problems in relation to crop restriction.
Hawaii. Plant. Rec. 1935 : **39** : 65–67.
Under the system of restrictive output it becomes important to have varieties capable of producing sugar at low cost per ton rather than per acre. In the revised breeding programme therefore sucrose content assumes a greater importance, combined with high yield per acre to reduce production costs, and also strong ratooning, low water and fertilizer requirements (efficient utilization) and low harvesting and transportation costs.

584. 633.61:575.12
Another step in cane breeding.
Hawaii. Plant. Rec. 1935 : **39** : 1–2.
By bringing together tassels of hundreds of cane varieties and allowing free pollination amongst them thousands of parental combinations are effected and the chances of getting a favourable combination of parents is very much increased.

585. 633.61–2:[581.44:581.2:575
EDGERTON, C. W., TIMS, E. C. and MILLS, P. J. 633.61–2.483–1.521.6:575
Stubble deterioration of sugar cane.
Bull. La. Agric. Exp. Sta. 1934 : No. 256 : Pp. 27.

This defect is manifested by failure of the stubble pieces of cane to produce a satisfactory number of vigorous shoots. The varietal differences in susceptibility to stubble deterioration are discussed and a new method of determining the resistance of varieties has been worked out ; it can be used both in good or bad years.

Susceptibility to red rot (*Colletotrichum falcatum*) is an important factor in stubble deterioration in some varieties.

586. 633.61–2.48–1.521.6:575
633.61:575.127.5:633.62
BOURNE, B. A. 633.61:575.127.5:633.174
Studies on the ring spot disease of sugarcane.
Bull. Fla. Agric. Exp. Sta. 1934 : No. 267 : Pp. 76.

Evidence is present that *Helminthosporium ocellum* Faris is the primary cause of this disease, causing lesions at first identical with eye spot, the ring spot symptoms developing later with the growth of associated saprophytes such as *Phyllosticta sorghina* Sacc.

The relative susceptibility of a number of varieties to the primary pathogen is described and also the results of several years of breeding resistant varieties, which afford the only method of control when the nitrogen content of the soil cannot be controlled. The most desirable combinations from the standpoint of proportion of resistant progeny, combined with commercially valuable characteristics are : P.O.J. 2725 x CP. 27–35, P.O.J. 2725 x CP. 27–108 and Co. 281 x CP. 27–108. The CP. varieties originate from the U.S. Department of Agriculture, Canal Point Station, CP.27–35 being a hybrid between D.74 and a selection from P.O.J. 213 while CP. 27–108 is a cross between P.O.J. 2364 and a further selection from P.O.J. 213. In general those combinations involving a high proportion of Chunnee (*Saccharum Barberi*) have given rise to a greater degree of susceptibility among the progeny, while those with a high proportion of *S. spontaneum* have given markedly resistant progenies. The reaction of sugar cane x sorghum hybrids has also been studied, Texas Seeded Ribbon and Kansas Orange, the two varieties of sweet sorghum used being immune. Among the progeny of the intergeneric cross markedly resistant forms appeared, but also a proportion of susceptible forms, indicating the necessity for rigid selection for resistance to ring spot if such hybrids are to be grown where conditions are suitable for the development of the disease.

587. CROSS, W. E. 633.61.001.4
Ensayos con variedades de cañas importadas. (**Tests with imported cane varieties.**)
Rev. Industr. Agric. Tucumán 1935 : **25** : 5–55.

Observations on new cane varieties produced by a number of different countries including Java, India (Coimbatore), South Africa and Formosa are reported. Various white and striped mutants of Kassoer have been examined in the hope that they would display a higher sugar content. These mutants have not yet however proved sufficiently rich in sugar to warrant their commercial introduction.

588. 633.61.0015(94)
Cane varieties in Australia. Greater number of Australia's canes introduced from New Guinea—Badila leading variety—extensive research work done by Colonial Company.
Facts ab. Sug. 1935 : **30** : 290–92.

A brief account of early introductions of canes from New Guinea and Fiji and with some notes on the activities of the Colonial Sugar Refining Co. and the Queensland Bureau of Sugar Experiment Stations, including their work with seedlings and the production of canes such as H.Q.409 S.J.4, etc.

589. Malpeaux, L. 633.63:575(44)
La production de la graine de betterave à sucre. (**The production of sugar beet seed.**)
Vie Agric. Rur. 1935 : **24** : 247-51.
In order to promote the production of good sugar beet seed in France competitions with money prizes have been arranged by the Commission dealing with various aspects of the problem of increasing the yield of sugar beet, and French plant breeding firms are invited to compete for a prize of 15,000 francs to be awarded in 10 years' time for the production of pedigree seed. Other prizes are to be offered for work on crossing wild beets and sugar beets. Any attempts to improve the quality of French beets by such crosses must be preceded by a preliminary study of the wild forms to discover which are the most suitable types. (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 131).

590. Oksijuk, P. 633.63:581.145.1:581.162
(**On the biology of blossoming in the sugar beet.**)
J. Inst. Bot. Acad. Sci. Ukraine 1934 : No. 9 : 75–84.
Cytological investigations on flowers of sugar beet fixed at intervals from 1 to 56 hours after opening shewed that pollen tubes first appeared on the stigma after 2 hours, fertilization first occurred after 3 hours, and after 24 hours all embryo sacs were shewing post-fertilization development. Germination of pollen tubes however still occurred after 50 hours, though the embryo sacs contained endosperm and pro-embryos.
Similar findings were made in several cultivated races and also in wild species (*Beta maritima* and *B. vulgaris* var. *perennis* Hal.).
It is considered therefore that beet is not protandrous, the opinion that it is so having arisen from the fact that the external appearance of the stigma does not correspond to its physiological condition, i.e. small stigmas with closed lobes are capable of receiving and germinating pollen grains.
The author suggests that conclusions about protandry or protogyny should be based on cytological observations rather than on external morphological observations of floral development.

591. Kohls, H. L. 633.63:581.162.3:578.08
Seed production of space-isolated vs. bagged mother beets and a discussion of some factors influencing the latter.
J. Amer. Soc. Agron. 1935 : **27** : 699–706.
Provided suitable material is used, selfed seed can be obtained from sugar beet protected by paper bags. The amount of seed per plant is less than in the case of isolated, unbagged beets, but this is offset to a certain extent by greater certainty of self-pollination, less time required and less likelihood of destruction of the mother beet by careless individuals.
The set of seeds can be increased by placing several bags on each beet, by using thin, large bags, by daily shaking and by avoiding shading the bags.

592. 633.63:581.192:575
Bougy, E. 633.41:581.192:575
Le phosphore dans les betteraves sucrières et fourragères et dans leurs hybrides.
(**The phosphorus in sugar beets and forage beets and in their hybrids.**)
Bull. Ass. Chim. Sucr. 1935 : **52** : 551–58.
During the history of the sugar beet the proportion of phosphorus in the ash has slightly increased but there has been a marked fall in the ash content as the sugar content has gone up and this has more than counterbalanced the rise in phosphorous percentage in the ash.
The present author describes phosphorus analyses made on the forage varieties Vauriac, Géante rose and Mangold and sugar varieties Vilmorin A and Kuhn, the technique of which is described.
The proportion of phosphorus, compared with the dry weight and still more as compared with the sugar content, was distinctly less in the sugar beets than in the forage varieties. F_2 hybrids of the cross Vauriac x Vilmorin A sugar beet shewed the same relationship, one lot with sugar content of 8.29 per cent containing 0.63 per cent P_2O_5 and another lot with sugar content 14.0

per cent containing 0.46 per cent P_2O_5 in the dry pulp. Differences of the same order were observed whether the beets were cultivated in rich or poor soil.
These differences were at the expense of the soluble phosphates, since the phosphates (and also nitrogen) insoluble in acetic acid were constant in all varieties and hybrids tested.

593. 633.63:581.43:575.12:633.416
SPENGLER, O., BÖTTGER, St. and BONNE, C.
Ueber die Züchtung einer aus der Erde herauswachsenden Zuckerrübe sowie deren Verarbeitungsfähigkeit. (**Breeding a sugar beet that grows projecting out of the soil and the possibility of its utilization in manufacture.**)
Z. Wirtschaftsgruppe Zuckerin dustr 1935 : **85** : 177–95.
The initial material from which the desired " green top " sugar beet with projecting root was obtained consisted firstly of beets from E strains with the green top character well marked, and secondly of F_1 hybrids from a cross between white " Lanker " fodder beet and the Strube sugar beet. The object was achieved by continued crossing and selection with these two types with special attention to developing first the " green top " character and subsequently the sugar content without a reduction in the size of the beet.
The resulting beet type exhibited only very slight development of the neck groove, and this according to the author makes the projection of the growing root from the soil a physiological necessity.
The practical advantages of the new beet type in harvesting operations, its uses and its chemical composition from the technical standpoint are discussed.

594. HÜLSENBERG. H. 633.63–2.7–1.521.6:575
Beitrag zur Züchtung einer nematodenfesten Zuckerrübe. (**Breeding a nematode resistant sugar beet.**)
Landw. Jb. 1935 : **81** : 505–23.
A full account of the work of E. Molz from 1912 in his attempt to isolate a nematode (*Heterodera schachtii*) resistant sugar beet by line breeding combined with continued individual selection, all opportunites for hybridization being excluded by suitable spacing. Selection, which was carried out on highly infected soil, was based not only on low degrees of infection but also on high root weight, though the latter character necessarily involved a low sugar percentage. Kleinwanzleben Mark E beets were used as a control.
The above procedure resulted in an increase in root weight while the absolute yield of sugar per unit of area was maintained at the same level as the control, but no genetically conditioned reduction in the degree of infection of the individual strains was observed. In 1922 therefore, under the influence of Shull's work on heterosis, crosses between the existing strains were made with the result that as compared with the control the beet weight from the crosses shewed an increase of 25.8 per cent and from the strains used in these crosses 11.8 per cent. Moreover this increase in weight was accompanied by an increase in yields of sugar per unit of area, the increase for the crosses being 17·8 per cent as compared with an average for the individual strains about equal to that of the control. As before, however, no general reduction in nematode infestation was observed in the crosses and the improved yields must be attributed not to increased resistance but to more vigorous vegetative development due to heterosis.
Nevertheless it must not be forgotten that in combating nematode injury the trend of selection adopted with a variety is not a matter of indifference as is shewn by the consistent performance of the E strain here.

595. MCDONALD, I. M. 633.63–2.8–1.521.6(96.9)
Tests of curly top resistant beets. Results of comparative grower-test plantings in Western Colorado show superiority of U.S. No. 1 variety.
Facts ab. Sug. 1935 : **30** : 212–14.
The performance of the U.S. No. 1 curly top resistant variety (Cf. " Plant Breeding Abstracts " Vol. V, Abst. 2) in thirty-nine field tests made under normal farm conditions in Western Colorado in 1933 and 1934 clearly demonstrated its superiority in resistance to curly top as compared with the representative European varieties also tested.
Further improvement in resistance and yield are expected to result from the continued selection and breeding that has been in progress with U.S. No. 1 since it was first released in 1933.

596. 633.71 Ibrido n.4

BENINCASA, M. 633.71:575.12

Un nuovo tipo di tabacco " Ibrido n.4." (**A new type of tobacco " Hybrid No. 4).**"

Boll. Tec. Tab. 1935 : **32** : 7–15.

The hybrid in question was one of nine of the F_2 from a cross between Burley drooping leaf and Sumatra sessile It was hoped to procure a variety of which the lower and middle leaves could be used for cigarettes and the upper and apical leaves for cigars of the Havana type of sufficient value to make it a commercial proposition.

The hybrid, which is briefly described, though far short of perfection, represents a considerable advance and was selected largely on account of its resistance to *Thielavia*.

597. 633.71:575

KOENIG, P. and RAVE, L. 633.71:575.11:582

Beiträge zur Tabak-Systematik und -Genetik. I. Sortenmerkmale am deutschen Tabak. (**Contributions to the systematics and genetics of tobacco. I Varietal characteristics of German tobacco.**)

Landw. Jb. 1935 : **81** : 425–503.

The present German systematics of tobacco varieties is unsatisfactory as it neglects the genetics of the individual characters. The present study therefore takes into account not only the possible inheritance or linkage of the characters but also the effect of external conditions on the plant characters.

The characters investigated were the leaf characters of the *Tabacum* and *Rustica* groups; position of the leaf and stem and root formation in the *Tabacum* group ; stem and root characters of the *Rustica* group ; inflorescence of the *Tabacum* group ; flower and capsule characters and the growth rhythm of the *Tabacum* and the *Rustica* groups.

The systematic position of the German varieties is discussed in the light of these new data.

598. BOLSOUNOV, I. 633.71:575(47)

L'amélioration des variétiés du tabac *Nicotiana rustica* L. (**The improvement of the tobacco plant *N. rustica* L.**)

Rev. Int. Tabacs 1934 : **10** : 65–83 ; 129–43 ; 193–210 ; 265–77.

Although *N. rustica* L. is not of as great an economic importance as *N. Tabacum* at present, its cultivation gives great promise from an industrial point of view. Tobacco may be obtained from it for cheap cigarettes, for pipes, for chewing and for snuff ; the high oil content of its seeds justifies its cultivation as an oil plant ; no plant surpasses certain of its forms in nicotine content, and recently it has been shewn that as much as 10 per cent or more of citric acid is to be found in the leaves of some varieties. Moreover *N. rustica* is easier to grow than *N. Tabacum* owing to its larger seeds and the greater vigour of the seedlings.

The species is a native of the New World, probably of South America and its ancestry is unknown, though it has been suggested that it is hybrid in origin, with *N. paniculata* as one of its parents. In the 300 years since its introduction into the Old World a vast multiplicity of forms has arisen, which the author attributes to frequent mutation and hybridization among the resultant forms. He quotes examples of mutations which have occurred in *N. rustica*, one of them " Aurea ' being analogous to the mutation which gave rise to the *Tabacum* variety White Burley. A study of the forms of *N. rustica* collected from all parts of the world shews that this species is at least as variable as *N. Tabacum*, a fact which the author illustrates numerically by shewing the range of variation existing between varieties in respect of a number of characters. The classification of this diversity of forms offers many difficulties and no satisfactory system has yet been devised. The author describes many of the forms found in different parts of Russia, Manchuria, Syria, Persia, North Africa, Ethiopia and Europe. They differ in many characters, such as habit, colour and texture of leaves, colour of flowers, nicotine content, resistance to

bacterial disease, precocity etc. etc., and correspondingly in the purposes for which they are used. The inheritance of characters, especially those of economic importance has not been very much studied in *N. rustica*. From his own experience the author lists some 21 characters and describes their mode of inheritance, i.e. whether they shew dominance or not. A few single factors affecting certain qualitative characters are known, but the majority of quantitative characters are governed by multiple factors. No linkage groups have yet been established, as is to be expected in view of the large number of chromosomes (n = 24).

Both *N. rustica* and *N. Tabacum* are very sensitive to differences of environment. For instance the relative humidity of the soil has a very great influence on many characters, though the effect varies considerably according to the character considered ; thus an average depression of 45 per cent of the yield was obtained in soil of 30 per cent humidity compared with soil of 60 per cent humidity, but the total yield of nicotine actually shewed a slight increase. The individual variation of the various characters of the plant differs greatly in different characters and the coefficients of variation for a series of characters are given.

The great genotypic variation which is found in this species usually exists within varieties as well as between them, and makes the material eminently suited to improvement by selection, though this is somewhat offset by the profound effects of the environment (climate, soil, culture, etc.). Another complication is introduced by the method of growing tobacco, involving the " topping " of the growing plants ; this process also has its effect on the characters of the plant, so that the characters of a plant which has been allowed to set seed cannot be taken as criteria of the behaviour of the same plant had it been topped. This and certain other considerations make it advisable to carry out selection on the basis of the behaviour of the progeny under standard conditions of cultivation, a proportion of the progeny being left to set seed and carry on the line. The morphological, chemical, ecomomic and physiological characters on which selection may be based are listed ; correlations exist between certain of these characters, but it is advisable wherever possible to determine them directly, as the correlations are not always universal. The method of selection most employed is pure line selection, selected plants being allowed to self under controlled conditions. The methods of selection and trial are described in detail. Mass selection only plays a subsidiary part, being chiefly used in the maintenance of the quality of a variety. During the process of selection the material is subjected to comparative trials of increasing stringency culminating, usually after 6 to 8 years, in collective variety trials carried out in different regions, it being necessary owing to the sensitivity of *N. rustica* to external conditions, to produce varieties expressly for each different regional requirement. This sensitivity is clearly seen in comparative trials conducted with different manurial treatments, in which the placement of the varieties concerned changes according to the treatment.

Hybridization is also employed in improving *N. rustica* varieties and the technique of crossing is described. In using this method for combining qualities from different forms selection begins in the F_2 generation and follows in subsequent generations roughly the same course as in selection from varieties. Selection is often difficult in the early generations owing to the difficulty of determining chemical or economic characters from small amounts of material, and in such cases may be left until succeeding generations. As well as crosses between varieties, interspecific hybridization can be employed, offering a method of combining the hardy characters of wild species with the economic characters of cultivated varieties. *N. rustica* is unfortunately difficult to cross with other *Nicotiana* species, but constant breeding (amphidiploid) hybrids involving it have been obtained by different workers.

Another application of hybridization is the utilization of hybrid vigour. *N. rustica* is suitable material for this purpose owing to the easy technique of crossing and the small number of seeds required to sow a given area. Substantial increases in yield have been obtained by the crossing of suitable lines, though here again the increase depends to a great extent on the external conditions.

Possible additional methods of breeding are afforded by the artificial induction of mutations, by the influence of X-rays, radium emanation, temperature, narcotics and so on. The author does not share the doubt often expressed as to the practical value of such methods, for, although it is true that the majority of such mutations are detrimental to the plant, they may yet be of positive value to the cultivator such as absence of nicotine or absence of lateral buds.

599. Chiritescu-Arva, M. 633.71:575(49.8)
L'Institut d'expérimentation pour la culture et la fermentation du tabac de Bucarest-Baneasa. (**The Experimental Institute for the cultivation and fermentation of tobacco at Bucarest-Baneasa.**)
Tech. Agric. Int. 1933 : **3** : 123–28.

The Institute started work in the field in 1929 and in the laboratory in 1930. The field work consists in studies of Rumanian and foreign varieties of tobacco, their characteristics and cultural requirements. Pure lines are also selected from local varieties, e.g. from the variety Ghimpatzi a superior line has been produced, and ultimately, it is hoped, there will be available pure lines of all the local varieties of the country.
Chemical, physiological, anatomical and phytopathological work is also in progress, and the station publishes a bulletin " Le Bulletin de la Culture et de la Fermentation du Tabac " whereby contact is made with other investigators.

600. 633.71:575(49.8)
633.71–2–1.521.6:575
Piescu, A. 633.71 Ghimpatzi 4
La sélection des tabacs en Roumanie. (**Tobacco breeding in Rumania.**)
XVI Congr. Int. Agric. Budapest 1934 : Rapport Spécial Roumanie. Sect. IV : Thème No. 2 : Pp. 4.

Prior to the formation of the experimental institute for the cultivation of tobacco, at Bucarest-Baneasa (see Abst. 599 above) breeding, under the control of the State Monopoly, consisted in the maintenance of varieties by mass selection.
The selection performed at that institute, however, has been pure line selection, and from the local varieties pure lines have been isolated excelling them in quantity and quality of yield. Attention has also been devoted to the production of disease-resistant lines, without success in the case of *Orobanche ramosa*, but with considerable promise of success in the case of the bacterial disease " wildfire," to which certain varieties have been found to be completely immune and others highly resistant.
The isolation of lines with low nicotine content has also been successful, e.g. Ghimpatzi 4 is a pure line from the variety Ghimpatzi and has a nicotine content varying from 0·174 per cent to 0·215 per cent. On the other hand, with a view to the extraction of nicotine, lines with as high a content as 4·74 per cent of nicotine have been selected.

601. 633.71:575(92)
633.71 Hybride 344
De tabakshybride 344. Hoopvolle proefresultaten in Besoeki. (**The tobacco hybrid 344. Promising results at the Besoeki Experiment Station**).
Alg. LandbWeekbl. Ned.-Ind. 1935 : **19** : 841–42.

Tests at Djember on the new hybrids 343 and 344 from the Besoeki station and a number of other new hybrids are described. The hybrids 343 and 344 were good in burning quality but somewhat rough. Crosses between them are very promising, some of them combining the vigour of 343 with the leaf quality of 344 and being slightly smaller in the leaf than 343.
The purity of 344 is almost complete and only remains to be tested in replicated plot tests. Differences from plant to plant have proved to be due to a very pronounced reaction to slight differences of soil etc. and as this is not observed in 343 it is hoped that it will also be absent in some of the hybrids.
At Soekoredjo replicated tests were made with 343, 349 and 333 (a hybrid between two Deli lines). Again 344 proved best and it seems possible that it will be capable of replacing the Deli types where these are grown.
Test of 343 and 344 against the old variety 272 were made at Djoeboeng and Kemiri : 344 was distinctly better than, and 343 equal to, 272 in quality. The burning time was slightly less (32·5 seconds compared with 36 for 343 and 39 for 272) but the difference may not be significant. The leaf of 344 was more mature in colour and had a smaller amount of green than the other two, and altogether shews a marked improvement on the older varieties.

602. GUTIERREZ, M. E. 633.71:575.1(91.4)
Six years of tobacco breeding.
Philipp. J. Agric. 1935 : **6** : 271–310.
Crosses were made for the improvement of Vizcaya, a native variety, used as the female parent, with Sumatra strains and constant hybrids.
Various types were found among the progeny and the most promising were chosen for line selection.
Certain strains are ready for distribution and are suitable for the commercial production of wrapper tobacco.
One of the hybrids shewed a marked resistance to mosaic.

603. NOLLA, J. A. B. 633.71:575.11.061.6
Inheritance in *Nicotiana*. I. Study of the glaucous and the yellow characters in *N. Tabacum* L.
J. Agric. Univ. P.R. 1934 : **18** : 443–62.
The character " yellow," a yellowish green colour of the leaves, found in the wrapper variety " Consolation " was shewn from the segregation in F_2, back-crosses and F_3 to be determined by a single recessive factor *y*, the normal green *Y* being dominant.
The " glaucous " character of the " Ceniza " variety was found to be due to two recessive complementary characters ce_1 and ce_2 giving 15 green : 1 glaucous in F_2 and corresponding ratios in back-crosses and F_3.
No evidence of linkage between the two characters was found.

604. EAST, E. M. 633.71:575.127.2
Genetic reactions in *Nicotiana*. II. Phenotypic reaction patterns.
Genetics 1935 : **20** : 414–42.
Data are submitted on about sixty species-hybrids in *Nicotiana*, the object of the study being to observe the relative effects of the parents in each case on habit of growth, flower form and leaf form.
No differences were observed between reciprocal hybrids whether the parents had the same or different chromosome numbers.
With respect to the " patterns " in the characters mentioned, the contributions of the two parents seemed to be approximately equal in all cases, except for certain qualitative effects (such as anthocyanin colours) which were transmitted as in variety crosses; apart from these no dominance effects were seen and a detailed analysis lent no support to the idea that the influence of a genom is in some way proportional to its number of chromosomes.
The author considers that it is the quantitative factors producing the pattern effects which are important in evolution and not the qualitative factors which produce the more drastic and more easily detected changes.

605. EAST, E. M. 633.71:575.127.2:581.162.5
Genetic reactions in *Nicotiana*. I. Compatibility.
Genetics 1935 : **20** : 403–13
The compatibilities existing between a number of *Nicotiana* species, representative of the groups existing in that genus, are shewn in tabular form, and it is pointed out that where differences exist between reciprocal crosses, greater compatibility is generally shewn when the species with more chromosomes is the female parent.
Leaving out of consideration such cases as are due to failure of the pollen tube to reach the egg, the author suggests that this tendency can be explained in terms of the chemical reactions suggested by Kostoff to explain incompatibility (Cf. " Plant Breeding Abstracts," Vol. I, Abst. 229); for if the species with the greater chromosome number is to be considered an allopolyploid, it is more likely to contain those chemical substances in the cytoplasm which are necessary for the harmonious development of the hybrid than is the diploid species.

606. KOSTOFF, D. 633.71:575.129:581.143.32
Heritable tumours in plants experimentally produced.
Genetica 1935 : **17** : 367–76.
Amphidiploids were obtained from the hybrid *N. glauca* (n = 12) x *N. Langsdorffii* (n = 9) by the method of accumulation of genoms (Cf. " Plant Breeding Abstracts," Vol. VI., Abst. 218) and like the F_1 and back-crosses they produced non-parasitic tumours, (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 922). Moreover, the progeny of the fertile amphidiploids also produced tumours, and so plants have been produced experimentally with heritable tumours.
The origin of such tumours is discussed, increased rate of somatic mutations in the hybrids being mentioned as a possible cause (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 892).

607. PERSIDSKY, D. and MODILEVSKI, I. 633.71:576.312.581.3
(Cytological and embryological studies of the chief varieties of *Nicotiana rustica* L.)
J. Inst. Bot. Acad. Sci. Ukraine 1935 : **4** : No. 3(11) : 33–68.
A detailed account of the cytological and embryological characteristics and peculiarities of a number of commercial varieties of *N. rustica* L. In eighteen of them obtained from the Ukraine, Abyssinia, Algeria, etc. the number of bivalents at metaphase was 24. The size of the chromosomes varied in the different varieties.
The fertilization process in *N. rustica* was found to be normal and the pollen tubes reached the micropyle in 24 hours. The embryo develops in the way characteristic for the *Solanaceae.*

608. SCHMIDT, M. 633.71–2.3–1.521.6:575(43)
Untersuchungen über das Verhalten von Tabaksorten und Nicotianaarten gegen den Erreger des " Wildfeuers," *Pseudomonas tabaci*, mit Berücksichtigung züchterischer Fragen. **(Investigations on the behaviour of tobacco varieties and *Nicotiana* species to the pathogen of " wildfire," *P. tabaci*, with regard to breeding problems.)**
Züchter 1935 : **7** : 208–16.
The results of the tests of a large number of species and varieties of *Nicotiana* already published (Cf. " Plant Breeding Abstracts " Vol. V, Abst. 1076) are given again.
Although all the varieties of *N. Tabacum* at present tested were susceptible to the disease there were more or less marked differences in reaction in varieties from different localities.
Although the resistant forms all belong to the *Petunioides* section, which is characteristically poor in nicotine, there is no connexion between nicotine content and resistance as some forms of this section are also very susceptible.
A comparison of Stapp's seedling mass infection method with that of individual plant inoculation shewed that by the former method even the resistant forms, if treated at the right stage, succumbed to the disease. Plants of *N. Sanderae* segregated into very susceptible, weakly susceptible and in one case very resistant.
The chances are probably remote of producing resistant forms which possess the other properties required by the trade by crossing *N. Tabacum* with species of the *Petunioides* groups, and a more likely method is by selection from the less susceptible forms of *N. Tabacum* from those localities where the susceptibility is least marked.

609. NOLLA, J. A. B. 633.71–2.8–1.521.6
Studies on disease resistance I. A tobacco resistant to ordinary tobacco mosaic.
J. Agric. Univ. P.R. 1935 : **19** : 29–49.
Further studies have been made on the reaction of the resistant Colombian variety Ambalema to ordinary tobacco mosaic. Infecton was found to follow inoculation at any age, as shewn by mild symptoms which later disappeared, and by inoculation of the juices extracted from the plants into Havana No. 38 (a susceptible tobacco) and *N. glutinosa.*

Ambalema was found to be very susceptible to cucumber mosaic, yellow cucumber mosaic, potato ring-spot, Wingards tobacco ring-spot and spot necrosis, and somewhat less susceptible to the mottle and vein banding viruses.
By qualitative studies on the lesions produced on leaves of *N. glutinosa* by inoculation with extractions from inoculated Ambalema and Havana No. 38 plants, it was shewn that the former variety is significantly more resistant to the ordinary tobacco mosaic, i.e. it prevents the increase of the virus in its tissues at the same high rate as is characteristic of susceptible plants.
A mild form of mosaic isolated from resistant plants is possibly to be regarded as an attenuation of the ordinary tobacco mosaic.

610. Deuss, J. J. B. 633.72:575.42(59.7)
Le thé et plus spécialement la sélection du théier. (**Tea and more especially selection of the tea plant.**)
Rev. Bot. Appl. 1935 : **15** : 580–603.

After a brief note on the extent to which selection of tea is practised in various parts of the world, historical and geographical data on the tea plant are summarized ; and some views are then cited on its origin and centre of distribution, which must apparently remain a mystery. The classification of the tea plant too is, in the author's opinion, still an undecided problem.
The types and varieties of tea which the author found in cultivation in tea plantations in various districts and experiment stations in Indo-China are noted. He regards the Shan type or the Assam type, which closely resembles it, as the most important for cultivation in Indo-China.
Selection for yield should be combined with selection for quality and an Assam or Shan type devoid of red tips and of red or small leaves, but with numerous well developed tips and very supple leaves is recommended as a good standard at which to aim.
The various methods used in Java in selection in seed gardens for purity of type and for yield and in plucking gardens for yield also are described and a system of selection for yield, suitable for application in Indo-China is set out.
Finally advisability of increasing the output of tea under existing economic conditions is considered.

611. Portères, R. 633.73
Variation chez les caféiers Libero-Excelsoïdes. (**Variation in the Liberia-Excelsa coffees**).
Bull. Com. A.O.F. 1934 : **17** : 666–76.

Vegetative segregation has been observed on a single individual in the case of *Coffea excelsa* trees from Sumatra grown at Dabou (Côte d'Ivoire) : plants bearing fruits of two distinct forms have appeared. A similar phenomenon was also observed on a local plant of *C. liberica*.
Homologous variation in fruit form has been observed in *C. Arnoldiana*, *C. abeocutae* and *C. excelsa* (sensu lato), namely the varieties *indeniocarpa* , *sphaerocarpa* and *longicarpa*. The *C. excelsa* described by A. Chevalier corresponds to none of these and is thought to be a distinct type.
In an attempt to find reliable distinguishing features between Liberia and the species grouped by Chevalier as *C. macrochlamys* it is mentioned that the former species has never been observed to bear yellow fruits, which are so common in the other groups, nor the three homologous fruit forms referred to above. The excessively large fruits often characteristic of *C. liberica* have occasionally been found also in the variety *longicarpa* of the *macrochlamys* group and are attributed to mutation ; striated fruits are observed in both groups, though never in the Canephora and Stenophylla groups.
No red pigmentation has ever been observed in the leaves of *C. liberica*, except in forms from Java that are possibly hybrids with the *macrochlamys* group. In most species, with the exception of *C. Arnoldiana* and the type Gros Indénié, the leaves of the *macrochlamys* group can be distinguished by a less erect growth.
Never more than 9 corolla lobes have been observed in the *macrochlamys* group, whilst in the Liberia group flowers with from 6 to 11 are frequent.
The crown in *C. liberica* is more definitely conical than in the other species.

612. 633.73:581.162.3:578.08
KRUG., C. A. 633.73:581.46
Hybridization of coffee. A preliminary study of flowering habits, and of methods of crossing.
J. Hered. 1935 : **26** : 325–30.

The commercial varieties of *Coffea arabica* are all self-fertile and a certain amount of self-pollination goes on as well as cross-pollination by insects, and possibly wind and gravity.
The main period of flowering occurs in the plantations in early spring and lasts two or three days, being preceded and followed by secondary flowering periods. The stigma is receptive at the opening of the bud.
To ensure self-fertilization the branches are protected with paper or cloth bags ; a set of fruit as high as 80 per cent is often obtained in this way.
In crossing, emasculation is carried out with a pair of scissors with notched blades, which cut the corolla tube without touching the style ; the former can then be removed with the inserted stamens. The flowers are then bagged, and when examination shews the stigmas to be receptive they are touched with pollen-shedding anthers. About 50 per cent of the flowers thus pollinated set fruit.

613. SAMPAIO, A. J. de 633.74(81)
Descriptiva de tipos regionais dos cafeeiros cultivados no Brasil. (**Description of the regional types of coffee cultivated in Brazil**).
Rev. Dep. Nac. Café Rio de J. 1935 : **3** : 233–35.
SAMPAIO, A. J. de
Descriptiva de cafeeiros do Brasil. (**Description of the coffee trees of Brazil**).
Rev. Dep. Nac. Café Rio de J. 1935 : **3** : 436–38.

Many of the regional varieties of coffee cultivated in Brazil are mutations or types that have originated locally and have not yet been properly described. The present series of articles is devoted to the description, with the object of ultimately being in a position to select from them the most suitable, of types collected from all the main regions, including the types commonly cultivated and any rare forms also occurring.

614. 633.74:575.12
KADEN, O. F. 633.74:576.16
Ordnung der Kakaobaumtypen für Zucht- und Bewertungszwecke. (**The arrangement of cacao tree types for purposes of breeding and estimating their value.**)
Tropenpflanzer 1935 : **38** : 367–78.

In order to improve the quality of cacao beans and to carry out the necessary operations in breeding for improvement a knowledge of the existing types and their characteristics is essential. The author recognizes only four species as corresponding to the types that produce the commercial cacao bean, viz. *Theobroma cacao* L., *T. pentagona* Bern., *T. leiocarpa* Bern., *T. sphaerocarpa* Chev., the last three being regarded as mutations of the first. Numerous local modifications of these four main species of course exist and may be conveniently classified according to the quality and especially the flavour of their seeds as fine cacao and ordinary cacao—the two classes recognized in the German trade. The characteristics of cacao beans of these two classes are described and the chemical constitutions underlying the various qualities of beans are exemplified.
Hybridization between fine and ordinary cacao trees is an important means of improvement, such crosses being characterized by the production of seeds of both the fine and the ordinary type. Two hybrid forms from West Africa are briefly described. Natural hybrids, well adapted to their particular local conditions will probably be discovered in the various countries where the cacao tree grows.
Illustrations are given of a few of the most important shapes of beans found in local types and mutations of *T. cacao*.

615. PITTIER, H. 633.74:575.74:575.127.2
Degeneration of cacao through natural hybridization.
J. Hered. 1935 : **26** : 385–90.
The Barlovento plantations of Venezuela were originally planted exclusively with Criollo cacao (*Theobroma cacao* L.) and their product was of a very high quality. Since the introduction of the so-called *trinitario* cacao referred by the author to *T. leiocarpum* the produce has deteriorated until at present, owing to its heterogeneous nature, it is in danger of being eliminated from the market. This degeneration the author ascribes to continued hybridization between the forms, with the production of an infinite variety of types.

616. KADEN, O. F. 633.74.0015(72.98)
Der Stand der Kakaoforschung in Trinidad. (**The position in cacao research in Trinidad.**)
Tropenpflanzer 1935 : **38** : 379–83.
A report dealing mainly with the achievements of the Imperial College of Tropical Agriculture in Trinidad on cacao with special reference to the work of Pound, Cheesman and Pyke among others. The relevant publications are already reviewed in " Plant Breeding Abstracts."

CAPSICUM 633.842

617. KAISER, S. 633.842:581.7:575.11–181
The factors governing shape and size in *Capsicum* fruits ; a genetic and developmental analysis.
Bull. Torrey Bot. Cl. 1935 : **62** : 433–54.
Statistical studies on mature fruits in F_1 and F_2 progenies of two crosses in *Capsicum annuum*, one between forms where fruits differed markedly in shape, the other between forms differing markedly in size of fruit, indicated that size and shape were genetically controlled independently, that is by different genetic factors, though there was some evidence in one of the crosses of linkage between factors affecting size and those affecting shape. There was a marked skewness in the distribution of fruit size in F_2 which disappeared when size was plotted logarithmically, indicating that the cumulative effect of the factors controlling size is geometric rather than additive.
More light was thrown on the inheritance of size when the development of the fruit from the early stages of the ovary onwards was studied. It was found that in some races the growth constant remained unchanged, giving a rectilinear relation between log (width) and log (length), while in others the growth constant increased at a certain stage of development (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 806) giving a characteristically sickle-shaped curve for this relation. In one or two crosses between the two types of race the so-called " curved " relation was dominant in F_1, but in another, the " straight " relation was dominant, while in both cases monofactorial segregation was observed in F_2. It is thus seen that in each cross there was a single major gene affecting the relative dimensional growth rates of the developing fruit.
The ultimate configuration of the mature fruit, apart from environmental influences depends on the interaction of the various six factors on the one hand and the factors controlling relative growth rates on the other.

RUBBER PLANTS 633.9

618. RAMAER, H. 633.912:576.354.4:576.312.35
Cytology of *Hevea*.
Genetica 1935 : **17** : 193–236.
In pollen mother cells of *Hevea brasiliensis* Muell. Arg., *H. Spruceana, H. guianensis* Aubl. and *H. collina* Huber., 18 bivalents were found. Meiosis is described in detail, as far as the fixation and the material allowed ; in general it follows the normal course.
At diakinesis about 22–23 chiasmata were found per nucleus, the degree of terminalization being variable both in the bivalents with two and in those with one chiasma.
Irregularities at metaphase I were found in certain male sterile clones and in a presumed hybrid between *H. Spruceana* and *H. brasiliensis*, univalents and multivalents being observed. In

another clone which was completely sterile in both sexes, asynapsis was found at meiosis. Metaphase I was represented by univalents scattered in the cytoplasm. Groups of these rounded themselves off into nuclei at interkinesis, underwent regular metaphase II and then formed "tetrads" with 6, 8 or more cells.

In the root tips of seedlings grown from *H. brasiliensis* seed, 36 chromosomes varying in size and morphology were found.

Discussing the taxonomy of *Hevea*, the author points out that the occurrence of rudimentary or incomplete whorls of stamens used as a diagnostic character in separating one group of species, is a feature of *H. collina* x *H. brasiliensis* hybrids, and hence that certain so-called species may in reality be hybrids.

The chromosome number n = 18 found by the present author differs from previous findings, Heusser having found n = 8 and Bangham n = 17.

619. Beckett, R. E. and Stitt, R. S. 633.913:575(75)
The desert milkweed (*Asclepias subulata*) as a possible source of rubber.
Tech. Bull. U.S. Dep. Agric. 1935 : No. 472 : Pp. 20.

Apart from the variations in rubber content of the desert milkweed due to different conditions of cultivation, harvesting, dormancy, etc., variations were found which were attributed to genotypical differences. Attempts, however, to isolate high yielding strains have so far failed; the flowers are self-sterile, artificial pollination is slow, tedious and uncertain and vegetative propagation has not proved feasible.

620. *Kraevoi, S. Ja. 633.913:576.312
(**On the question of the differentiation of the karyotype of *Scorzonera tau-saghyz*.**)
Sovetskaja Botanika (Soviet Botany) 1934 : No. 6 : 45–48.

The root tips of material obtained from various sources were examined and the diploid number was found to be 24.

In the first karyotype described, all the chromosomes were two-armed and had attachment constrictions which in two pairs of chromosomes were median and in the remaining five pairs sub-terminal. Six chromosomes had spherical satellites; and one chromosome had a second additional constriction and a spherical satellite on a much shorter filament than in the other cases; its homologous partner had neither a second constriction nor a supplementary satellite, so that this pair of chromosomes may be termed heterochromosomes.

In the second kind of karyotype shewn, though each chromosome, as before, had its own definite morphological characteristics, these are much less marked than in the first karyotype and the satellites were absent. In fact the two karyotypes differ considerably not only morphologically but also in the dimensions of the chromosomes and the only common features were the chromosome number and the two-armed condition.

On the basis of the above differences and of observed instances of triploid, tetraploid and hexaploid complements in *Scorzonera tau-saghyz* as well as aberrant chromosome numbers in excess of the normal number, it is surmised that the plant form in question exhibits a highly labile system which should give rise to species, or at least subspecies. This assumption is in agreement with the diversity of phenotypes of the species as seen under natural conditions.

A further study of a larger collection of material from the locality where the species grows would be necessary to decide the question.

FRUIT TREES 634

621. Yeager, A. F., Latzke, E. and Berrigan, D. 634(78.4)
The native fruits of North Dakota and their use.
Bull. N. Dak. Agric. Exp. Sta. 1935 : No. 281 : Pp. 26.

Brief botanical descriptions and recipes for preserving certain of the more useful native fruits of North Dakota.

Many of the species mentioned are worth cultivating, and several have been or might be used in breeding work.

* A full translation of this paper is on file at the Bureau.

622. Evreinoff, V. A. 634.11 Boskoop Belle :575.22:575.12
Sur le polymorphisme des fruits chez la " Belle de Boskoop." (**On the polymorphism of the fruits of the " Boskoop Belle " apple.**)
Rev. Hort. Paris 1935 : **107** : 465–66.
Four types are illustrated and described—two extreme and two intermediate. The constant and marked polymorphism of this apple is regarded as indicative of hybrid origin.

623. 634.11:608.3(73)
Cook, G. E. 634.31 Robertson Navel : 608.3(73)
New fruits receive Government patents.
Northw. Fruit Grower 1935 : **7** : No. 6 : p. 6.
Patents have been granted for a new apple (a sport from York Imperial) and a new orange tree (see " Plant Breeding Abstracts," Vol. VI, Abst. 256). The apple is particularly valuable because of its rich purplish red colour and its early maturity. As compared with the Washington navel the new variety of navel orange tree is characterized by a heavier and more uniform yield and fruits occurring in clusters and ripening 2–3 weeks earlier.

624. 634.11–2.111–1.521.6–1.524.4
Žavoronkov, P. A. 634.21–2.111–1.521.6–1.524.4
(**Use the fruit trees of Trans-Baikalia in breeding cold-resistant varieties**).
Naučnoe Plodovodstvo (Scientific Fruit Growing. Bull. Lenin Acad. Agric. Sci., Res. Inst. Fruit Grow. I. V. Michurin) 1935 : No. 1 : 52–56.
In 1934 an expedition was sent out to study the wild fruit trees of Siberia and a general description is here given of the nature of the forms collected in the case of apples, apricots, cherry (*Prunus virginiana*) and hawthorn.
All the forms are characterized by extreme frost-resistance and special mention is made of large forests of apricot in the Trans-Baikalia region, which will stand frosts of up to —39°C. and are regarded as specially promising for breeding northern forms both of apricot and almond.

625. Coe, F. M. 634.21(79.2)
Apricot varieties.
Bull. Utah Agric. Exp. Sta. 1934 : No. 251 : Pp. 60.
This bulletin contains information on the botany, origin and history of the apricot, a review of literature on varieties, variety tests, hardiness, vigour, yield and blooming season of varieties, in addition to descriptions of the types of apricot grown in Utah and a bibliography.

626. 634.25:575(47.7)
Shcherbina, M. L. 634.25–2.111–1.521.6
(**Research on peaches in the Kyiv district**).
J. Inst. Bot. Acad. Sci. Ukraine 1935 : **4** : No. 4(12) : 117–25.
An account is given of the performance of five groups of peach seedlings which are being selected and bred for frost-resistance with the ultimate object of introducing peach cultivation into the forest steppes in the Ukraine. One collection the " August " group (F_3), raised from an unknown American variety, has trees that are immune to curly top and give a good yield of fruits of dessert quality.
The most frost-resistant group consists of F_1 seedlings of Chinese origin, their yield is average and the fruits can be used for jam or wine.

627. 634.25:575.183
Evreinoff, V. -A. 634:575.183
Sur la question des métaxénies chez le pêcher. (**The question of cases of metaxenia in the peach**).
Rev. Gén. Bot. 1935 : **47** : 465–79.
An enumeration of records of metaxenia in the pear, plum, apple, date and in a melon x cucumber cross is followed by details of the author's own observations on the natural occurrence of the

phenomenon (wide–spread in some instances) in peach orchards. The descriptions include an instance of metaxenia between peach and nectarine and an example of metaxenia exhibited in one half of a peach and not in another.
Practical importance is attributed to these observations which are held to indicate the need for careful selection and isolation of varieties in orchards where such effects of cross-pollination are undesirable.
A bibliography is appended.

628. ROSBOROUGH, J. F. 634.521:575:581.162.5
Pecan varieties up to date.
Proc. 13th Ann. Meet. Tex. Pecan Gr. Ass. 1933 : 19–21.
The choice of variety is important, not only from the point of view of quality of the produce, but also because of the need for suitable pollinators for varieties incapable of self-pollination. The compatibilities of a few varieties are described.

629. SMITH, C. L. and ROMBERG, L. D. 634.521:581.162.3
Further studies on periods of receptivity and pollen viability in the pecan.
Proc. 13th Ann. Meet. Tex. Pecan Gr. Ass. 1933 : 76–85.
The period of receptivity was determined in ten varieties on the basis of the success of pollination. In no case did the period of maximum sensitivity coincide with that of maximum pollen shedding and in most cases the two periods did not overlap. Recommendations as to suitable varieties to employ as pollinators are made on the basis of these studies.
The viability of the stored pollen of four varieties was tested and it was found that setting could be still obtained, using pollen that had been stored ten or even more days.

630. SHUHART, D. V. 634.521:581.162.3:575.183
Pecan pollination.
Proc. 13th Ann. Meet. Tex. Pecan Gr. Ass. 1933 : 9–14.
A popular account of the progress of fertilization, indicating the possibility of xenia and emphasizing the need for pollination studies.

631. YARNELL, S. H. 634.521–1.541.11:575(76.4)
The pecan seedling rootstock test to date.
Proc. 13th Ann. Meet. Tex. Pecan Gr. Ass. 1933 : 47–50.
Seedlings from different varieties of pecan are being grown at several places in Texas in a co-operative test to compare their respective values as rootstocks. When possible, the male as well as the female parent variety is noted so that the breeding value of varieties may be estimated.
The relative value of seedlings from different varieties varies a good deal from place to place and from year to year, but the average rating does give an indication of relative vigour.
Records on the growth of budded shoots are to be made.

632. SLATE, G. L. 634.54–2.111–1.521.6(74.7)
Winter injury of filberts at Geneva 1933-34.
Rep. Proc. 25th Ann. Meet. Nth. Nut Gr. Ass. Mich. 1934 : 36–40.
A report on the winter-hardiness of filbert varieties during the very severe winter of 1933–34. The flowers of the filbert shewed a greater range of hardiness than the blossoms of peaches or sweet cherries and the staminate flowers of a few varieties were definitely hardier than peach blossoms. On the other hand in one orchard the pistillate flowers were hardier than the catkins. Comparing the records for 1932–33 and 1933–34 only two varieties, Italian Red and Red Lambert, can be regarded as satisfactory in hardiness in wood and catkin.
The first is only suitable as a pollinator, but Italian Red is most promising both in nut quality and in yield.
As breeding material the Jones hybrids and other similar hybrids from crosses between Rush and various filbert varieties are thought likely to produce sufficiently hardy types ultimately.

633. HIGGINS, B. B. 634.58–2.484–1.521.6:575
Breeding peanuts for disease resistance.
Phytopathology 1935 : **25** : 971–72.
Since 1931 about 200 crosses have been made with 15 varieties in different combinations. The records for most of the principal characters indicate that the F_1 generation plants are intermediate between the two parents and Mendelian segregation occurs in F_2.
Resistance to the leaf spots, *Cercospora personata* and *C. arachadis*, seems to be transmitted independently, high resistance to the one form being often combined with high susceptibility to the other.
Some hybrid strains have proved very susceptible to *Sclerotium rolfsii*—others the reverse but no definite information on inheritance has been obtained yet.

634. PRIEGO, J. M. 634.63 Blanqueta
Una notable variedad de olivo. (**A notable variety of olive**).
Agricultura Madrid 1935 : **7** : 573–74.
A survey is being made of the Spanish olive varieties. One of the most outstanding in the eastern region is a variety of the name Blanqueta. It is distinguished by extremely high yield of fruit born annually, yielding satisfactorily even on ground too poor for most varieties. The fruit is of medium size and good oil content. Its introduction into other areas is recommended.

635. ORTEGA NIETO, J. M. 634.63:581.331.2
Características del polen y la variedad en el olivo. (**Pollen characteristics and the variety question in the olive.**)
Bol. Inst. Invest. Agron. Madrid 1935 : **1** (2) : 119–40.
In view of the extreme hybridity and variability of the Spanish olives various attempts have been made to distinguish them by a number of means, including pollen examination. The anthers are treated with clove oil before expressing the pollen. Micro-photographs and pollen grain size data are presented, shewing clear varietal differences to exist in respects of both size, shape and character of the exine.

636. SCHAFFNER, J. H. 634.651:581.163
Artificial parthenocarpy.
J. Hered. 1935 : **26** : 261–62.
When the water relations of an isolated carpellate plant of the tropical papaya (*Carica papaya* L.) were disturbed by drastically reducing the number of leaves, the abscission layer, which normally causes the unfertilized carpellate flowers to drop off, was not produced, and fruits were developed parthenocarpically.
In view of this experiment it is suggested that the various phenomena of ectogony are due, not to hormonal substances emanating from a parasitic embryo and endosperm, but rather to physiological disturbances producing new gradients in the tissues and organs concerned.

637. GUSTAFSSON, C. E. 634.71
Rubus kollundicola C. E. Gust. (***R. kollundicola* C. E. Gust.**)
Svensk Bot. Tidskr. 1935 : **29** : 407–09.
The Latin diagnosis of the type form of *R. kollundicola* C. E. Gust. n sp. with a note on its discovery. The chromosome number is 2n = 35 indicating hybrid origin. One parent may, it is believed, be a *pyramidalis* form.
A new variety *scabior* C. E. Gust. is also given a Latin diagnosis.

638. DARROW, G. M. 634.711–2.42–1.521.6
Susceptibility of raspberry species and varieties to leaf spot (*Mycosphaerella rubi*) at Beltsville, Maryland.
Phytopathology 1935 : **25** : 961–62.
The relative resistance to *Mycosphaerella rubi* of the species and varieties tested is tabulated. Twelve of the Asiatic species mentioned are highly resistant and incidentally, most of them are immune from or highly resistant to anthracnose and spur blight. Moreover several little known American red and black varieties are most resistant, so that resistance could be obtained both by breeding from these resistant American forms and by crossing American with Asiatic species.

639. 634.711.3 Taylor
634.711.3:575.12(73)

Taylor, a new red raspberry.
Horticulture 1935 : **13** : p. 407.

Taylor, which originated from a cross between the English variety Lloyd George and the Canadian variety Newman, possesses the large size and regular, long conical shape of the former combined with the firmness and light colour of the latter. It is slightly earlier than Latham which it far surpasses in quality, being nearly equal in this respect to Cuthbert. The plants are unusually vigorous and tall and hold the fruit up well. So far Taylor has proved winter-hardy, but no conclusions can yet be drawn about its resistance to mosaic. It should prove one of the best varieties for the home garden and may, it is believed, replace all other late varieties.

640. 634.722 Red Lake
634.722(77.6)

CLARK, J. H.
Small fruits.
N.J. St. Hort. Soc. News 1935 : **16** : p. 739.

A mention of the new Red Lake currant produced by the Minnesota Station. It is notable for its very long clusters and large fruits.

641. 634.75 N.J.35
634.75:575.12
634.75(71.5)

The small Fruits Council holds its first meeting.
N.J. St. Hort. Soc. News 1935 : **16** : p. 739, 746.

A note on an inspection of a number of new strawberry varieties and other small fruits at the Horticultural Farm, New Brunswick. N.J.35, an early ripening strawberry seedling from a Howard 17 x Aberdeen cross, is to be tested further.

642. CHODAT, F. 634.75:575.1
L'amélioration du fraisier à l'Ecole cantonale d'horticulture de Châtelaine-Genève. (**Strawberry improvement at the Cantonal School of Horticulture at Châtelaine-Genève.**)
Rev. Hort. Suisse 1931 : No. 11 ; 1932 : No. 2 : Pp. 11.

Degeneration in the strawberry is usually due to prolonged vegetative propagation and can be checked by hybridization either by self or cross-pollination but for real improvement an organized plan for the combination of desirable characters and the elimination of those that are undesirable, is essential.

Crosses between the two varieties Président Dufour and Madame Moutôt are described, as both possess qualities which could with advantage be united in one variety.

The F_1 was high-yielding and shewed a segregation for fruit shape into a number of different forms including those of the parent varieties and one family is especially noted for its earliness, perfect flowers and good fruit characters.

643. MOOG, H. 634.83:581.45
Untersuchungen über die Variabilität des sortentypischen Blattes von *Vitis* L. (**Investigations on the variability of the *Vitis* L. leaf characteristic for different varieties.**)
Gartenbauwiss. 1934 : **8** : 685–712.

By means of leaf measurements taken from clones of large numbers of varieties and hybrids in one year, it was possible to distinguish the leaves of very similar varieties, provided a sufficient number of leaves was sampled for each variety. The relative value of certain measurements is compared.

It is concluded that within certain limits, the method of measurement here tested is suitable for use in genetic analyses. It can be applied to some extent to the differentiation of viticultural stocks and European varieties.

644. STUMMER, A. and FRIMMEL, F. 634.835:575(43.7)
Richtung und Ziele der Rebenzüchtung bei uns und anderswo. (**Trend and aims of vine breeding in our country and elsewhere.**)
Das Weinland 1934 : **6** : 380–83.

The impulse given to vine breeding in foreign countries such as France by the necessity of producing stocks resistant to phylloxera and *Peronospora* and the present attempt to obtain direct producers of a satisfactory type is mentioned with a brief reference to the extensive tests of various hybrids in the state vineyard at Mutenice and breeding work in Czechoslovakia. (Cf. " Plant Breeding Abstracts," Vol. III, Abst. 737.)

The reasons for the relatively small amount of genetic research on vines are stated, with special emphasis on the difficulty of analysing complex physiological characters such as time of maturity, resistance, flavour, etc., and on the lack of established correlations between such properties and morphological features in vines.

The inclusion of Czechoslovakian with the French varieties as material from which to breed direct producers is recommended.

In the authors' opinion the superior flavour of improved vines is fundamentally due to the absence of *Berlandieri* types in conjunction with *riparia*.

Experiments with Malingre have given promising results as regards early maturity, a characteristic, however, frequently bound up with undesirable degeneration phenomena, and therefore not an entirely desirable aim. Grapes for wine making should receive more attention by the breeder and the selection of stocks and clones should not be neglected.

645. STUMMER, A. and FRIMMEL, F. 634.835:575(43.72)
Bericht über die Rebenzüchtungsarbeiten des Jahres **1934.** Deutsches Gebiet von Mähren. (**Report on vine breeding activities in 1934. German district of Moravia.**)
Verlautb. deuts. Sekt. mähr. Landeskulturrat. 1935 : No. 1 : Pp. 6.

The seedlings from selfings proved much less able to withstand the winter frosts of 1933.

The stock of seedlings was increased by 600 mostly obtained from the 1932 crosses.

The authors' theory that superior flavour is due to a series of loss mutations was, it is claimed, borne out by crosses of Malingre, a vine which approaches nearly the extreme limit of possible loss mutations. Selfings had almost invariably the same flavour as the female parent, very sweet but without perceptible other characteristics. For this reason the Malingre variety can be used in hybridization as an indicator for the composition of the flavour of other varieties having various components of flavour that are absent in Malingre. A report on the question of flavour is contemplated ; in the meantime valuable data have been obtained for further breeding work.

Evidence of the dependence of the higher berry weight in crosses as compared with selfings within the same variety on competition for space is presented in tabular form.

Following crossing there was no increase in berry weight but the seed weight and dimensions were greater and this was so even though the crosses were between two stocks from a single clone, and therefore genetically similar in constitution. Hence the increased growth of the embryo must be attributed not to heterosis but to a physiological stimulus due to the fact that the genom of the pollen parent has on fertilization been transferred to a physiologically different cytoplasm in the egg-cell, the cytoplasmic differences in a stock or clone being ultimately due to the sum total of the particular developmental conditions of the bunch. Consequently in order to obtain useful and physiologically vigorous seedlings, crosses between two stocks of a single variety or clone are recommended in preference to selfing.

Tables are given shewing some features of the performance of the 1934 seedlings from a large number of crosses, the results of a heterosis experiment and records of a number of mutations.

Thirty-three of the new varieties were selected as worth using in the establishment of clones.

646. PIROVANO, A. 634.835:575.252
La selezione gemmaria della vite. (**Bud selection of the vine.**)
Progr. Vinicolo 1933 : Pp. 8.
Necessary economies may be effected by the use of better methods of cultivation but still more important is an improvement of the vines themselves which may be made by careful bud selection. Observations on the yield of existing vines will shew from which to select material for grafting and a close look-out should be kept for mutations which may prove worth propagating.

647. 634.835:575.42
MERJANIAN, A. and SELÉNIN, I. L. 634.835:581.165:575.22
(**Methods of breeding in vines.**)
Trav. Sci. Sta. Vitic. Oenol. Anapa 1932 : No. 10 : Pp. 40.
The first stage in vine breeding consists in freeing the plantations from all impurities in the form of inferior varieties and clones. This is normally a rather lengthy operation but a method has been devised and is here described, for judging more rapidly as to whether a clone deviates significantly or not from the type. A study of the variation in different characters has shewn that in regard to each character the coefficients of variation become larger as the degree of expression of the character increases in one direction and smaller in the opposite direction, reaching a minimum at the extreme of expression of the character in this latter direction, where the coefficient of variation thus approaches zero. Thus in the case of leaf indentation, the coefficients rise with reducing indentation and fall with increasing indentation, so that the forms with the maximum indentation have an almost zero coefficient of variation, i.e. are constant. In studying varietal purity therefore for each variety certain characters are chosen in which the expression approaches the limit of minimum variation. In this way any clone in which deviations from the typical expression of the character concerned occur in one direction or the other can be regarded as a distinct clone and thus an impurity. At least two such characters should be obtained and the proof of the existence of a separate clone is the deviation of the two characters concurrently. If one character is present in the degree of zero variation then a deviation in a single direction of this character alone is sufficient.
Tables are given shewing the degree of expression for zero variation in a number of characters and the expression of these characters in a number of varieties and in certain of their variants. The successful application of the method depends on the thorough study of the characters in the first place ; it can then be used with the greatest rapidity. At the Anapa Viticulture Station it has served for identifying a number of very clear-cut variant clones of several varieties in which such had not hitherto been detected, each determination taking not more than a few hours. This affords an excellent method for roguing in selecting planting material and saves a great deal of time in breeding by hybridization, the procedure of which is described.
Descriptions are given of a number of variants found in some of the varieties growing at Anapa, with comparisons in many cases between the variant and the original form in respect of acidity, sugar content, yield, fertility and other characters.

648. BRANSCHEIDT, P. 634.835:581.143:575.42
Zur Frage der Determination der Internodien in verschiedener Höhe des Jahrestriebes bei der Rebe und ihre Bedeutung für Rebenveredlung und Rebenzüchtung. (**On the question of the determination in the vine of the internodes at various heights on the annual shoot and the importance of this determination for vine grafting and breeding.**)
Gartenbauwiss. 1934 : **8** : 515–72.
A study of the development and growth, at different seasons, of the internodes or buds situated at various heights on the stem of European *Vitis vinifera* forms and American hybrids. An indication is given of the significance of the results for the selection of material for vine-breeding.

649. 634.872:575.1

Alberto Pirovano e le sue nuove varietà di uve da tavola. **(Alberto Pirovano and his new varieties of dessert grapes).**

Progr. Vinicolo 1933 : Pp. 4.

As a result of thirty years of vine breeding involving more than 3,000 hybridizations 14 strains have been considered worth naming and distributing for cultivation. The most noteworthy of these are briefly described.

650. Bolgareff, P. T. 634.872:581.6

(To the technical characteristics of some grape sorts in connexion with transport and non-alcohol manufacturing.)

Publ. Anapa Zonel Exp. Sta. Div. Non-alcohol Mfrg. 1931 : No. 8 : Pp. 45.

The grape is now used in Soviet Russia not for wine but mainly for the preparation of food items and medicinal products. Varieties of a new type are required for this purpose. The testing of a number of varieties for suitability for the new forms of utilization forms the basis of the present bulletin. The methods of study are discussed in detail, including various methods for determining such properties as keeping capacity and transportability and the measurement of the factors comprising them (in the latter case especially the firmness of attachment of the fruits). The results given by a number of different table varieties in these trials and in quality tests are tabulated and described. These quality tests include observations of the size, form and character and degustation of the fresh fruit and also of the proportion of flesh to stone and skin and the yield of must per kg of grapes, etc.

FORESTRY 634.9

651. 634.972:581.331.2:575.12
634.972.3:581.331.2
633.584.3:581.331.2

Bogdanov, P. L. 634.972.6:581.331.2

(Methods of preserving pollen of forest trees in connexion with breeding).

Sovetskaja Botanika (Soviet Botany) 1935 : No. 1 : 98–107.

The growing importance of afforestation in the Soviet Union has brought the problem of hybridization very much into prominence. The forms and species to be crossed frequently flower at different times and successful hybridization often depends upon a suitable method of pollen preservation. Experiments were carried out on the pollen obtained from young branches kept in water in the laboratory, which were found to be capable of furnishing good pollen from early December on throughout the winter.

The best conditions for artificial germination of the pollen were first determined experimentally for the different species under study, after which the germination percentage of the fresh pollen was determined. This varied greatly from species to species of the same tree, for instance in poplars *Populus laurifolia* gave a germination of 90 per cent whilst *P. tremula* and *P. suaveolens* gave only 35 per cent.

Observations were then made on the effect of different conditions of preservation upon the pollen germination. The different species of poplar again varied in their reaction but the best method of preservation was refrigeration, at a temperature between + 3 and — 3°C., under which conditions the pollen of *P. laurifolia* was kept successfully for 15 days and *P. suaveolens* germinated up to 12 per cent even after 45 days. Even temperatures as low as — 15°C. did not entirely kill the pollen of *P. tremula* and had no effect at all on the viability of *P. laurifolia* pollen. Both excessive moisture and desiccation reduced germination and preservation in a desiccator was definitely unfavourable.

Various species of *Salix* were studied on similar lines. In *S. viminalis* retention for 20 days at a temperature between + 3 and — 3°C. left the germination unimpaired and a certain amount

of germination was retained up to the fiftieth day. *S. acutifolia*, with a much lower normal germination percentage, retained its pollen viability for an equal length of time, as did also *S. dasyclada*, *S. caprea* and the hybrid *S. phylicifolia* x *S. viminalis*. Again extremes of moisture content were unfavourable.
The most suitable germinating media and the duration of viability of the pollen are tabulated for the above mentioned and a number of other forest species.

652. TUBEUF, C. F. von 634.972–2.484–1.521.6(4)
Werdegang der Erforschung der sog. Ulmenkrankheit in Europa. (**The development of research on the so-called elm disease in Europe**).
Z. PflKrankh. 1935 : **45** : 49–78, 161–89.
A comprehensive survey of the literature on this disease, generally assumed to be due to *Graphium ulmi*, and its mode of distribution. The problem of resistant types of elm is also touched upon in the references cited on prophylactic measures against the spread of the disease.
The second paper deals mainly with the pathology of the disease and preventive measures which include the selection of resistant elm species, varieties, races or hybrids. A necessary preliminary to selection is a thorough knowledge of the distinctive characteristics of native German elms and a table shewing the morphological and ecological features of *Ulmus glabra*, *U. montana* and *U. effusa* is accompanied by notes on the properties of their wood.
Research on these three species should be directed towards discovering (1) whether resistant types occur, (2) whether the native German elms could be crossed to advantage with resistant foreign species, and (3) whether elms that have remained healthy during an epidemic of the disease owe their immunity merely to environmental conditions.

653. GUINIER, P. 634.975:575.242:581.44
Une curieuse mutation chez le sapin (*Abies alba*) : les sapins sans branches.
[**A peculiar mutation in the fir** (*A. alba*) : **firs without branches**].
C.R. Soc. Biol. Paris 1935 : **119** : 863–64.
The main stem of the three species of *A. alba* which form the subject of this note shewed a complete absence of branching The stem, which was very thin, was about 90 cm. long and ½ cm. in diameter. The region of most recent growth was marked by a circular ring of projecting leaves. One of the three trees was bifurcated half way up the stem, from which point two similar stems had developed. In view of the rarity of survival of trees of this type and the fact that all three specimens were characterized by slow growth, sterility, lack of vigour, the mutation to which the condition is ascribed is therefore described as lethal.

654. KIENER, W. 634.975:577.8
Unisexual limber pines.
Science 1935 : **82** : p. 193.
Observations from the Rocky Mountain National Park, Colorado, suggest that at timberline the limber pine (*Pinus flexilis* James) has a tendency to a separation of the sexes instead of the normal monoecious condition. A similar phenomenon in *Pinus montana* Miller has been reported from the Swiss Alps.
Any other data on the occurrence of this tendency will be welcomed.

655. LANGLET, O. 634.975–1.531.12:575
Proveniensfrågan i ny belysning. (**A new light on provenance problems.**)
Tidskr. Skogen 1934 : No. 11 : Pp. 8.
A continuation of the work reviewed in " Plant Breeding Abstracts," Vol. V, Abst. 508, on the relation between the dry matter content of the pine, *P. sylvestris*, and the locality in which it grows.

Plants were tested from regions ranging from within the polar circle to Italy and the previous findings of the author on the correlation between the dry matter content and winter-hardiness as well as climate were confirmed.
The investigations are being continued and the question arises whether the variations noted are inherited or are merely the effect of environment.

VEGETABLES 635

656. Brown, H. D. 635:575.12
The use of hybrids in vegetable production.
Proc. 20th Ann. Meet. Ohio Veg. Grow. Ass. 1935 : 5–8.
A popular account of the production of hybrids and the advantages to be derived from growing them.

657. Beaumont, A. B., Snell, M. E., Doran, W. L. and Bourne, A. I. 635.25:575(74.4)
Onions in the Connecticut Valley.
Bull. Mass. Agric. Exp. Sta. 1935 : No. 318 : Pp. 31.
Varieties and strains of onions have been collected and grown for comparison, and certain of the better strains have been inbred. Crosses have also been made, but without much success. Different methods have been employed in growing the seed, the best results having been obtained by starting the plants in the greenhouse in early February and transplanting to the field, a method which appears to have commercial possibilities.

658. Ono, Y. 635.25:576.312.35
(Chromosome numbers in *Allium*.)
Jap. J. Genet. 1935 : **11** : 238–40.
The chromosome numbers of 22 species, five varieties and 10 agricultural varieties of *Allium* are recorded, the numbers for 12 species, three varieties and ten agricultural varieties being determined for the first time by the author. Seven different numbers were noted—three of which (7, 8, 9) constitute a basic series, the rest being multiples of these.
A. rubens is known to have more than 34 chromosomes though the exact number has not been established.
A. fistulosum var. *viviparum*, shewed mixoploid tissue in the root tip.

659. 635.25–2.111–1.521.6:575
Magruder, R. and Hawthorn, L. R. 635.25:581.165.1:575–184
Effects of freezing and cold weather on immature onions.
Circ. U.S. Dep. Agric. 1935 : No. 355 : Pp. 12.
The different reactions of 55 strains, representing 20 varieties of onions, on exposure to minimum temperatures ranging from 18°–32°F on successive days while in a vigorous state of vegetation suggest that doubling (i.e. the production of more than one distinct bulb) and resistance to freezing are partly genetic in nature—a possibility that should interest the breeder.

660. Jones, H. A., Bailey, S. F. and Emsweller, S. L. 635.25–2.7–1.521.6:575
Field studies of *Thrips tabaci* Lind. with especial reference to resistance in onions.
J. Econ. Ent. 1935 : **28** : 678–80.
Tests of varieties and strains of onions, based on counts of larvae per plant, shewed White Persian to be markedly resistant.
The variety is an introduction from Persia, of little commercial value, and is considered to owe its resistance to its spreading type of growth, circular cross-section of the leaves, thickness of leaf tissue and the colour of the leaves.
Breeding is in progress with a view to incorporating this resistance in a commercial variety.

661. WALKER, J. C. 635.34–2.484–1.521.6:575.11
Types of disease resistance.
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : 206–08.

Discussing in particular the nature of resistance to the vascular *Fusaria*, the author points out that for its full understanding it is necessary to investigate the genetic basis, the relation of environment to the expression of resistance of the host and to the parasitic activity of the fungus, the relation of the parasite to the host tissue and the genetic variability of the parasite.

In some plants, eg. flax, tomato, tobacco and usually in cotton a complex genetic basis for resistance is present, while in others, e.g. pea, resistance is controlled by a single gene, which is dominant to susceptibility. In cabbage two types of resistance are found, one, type A, controlled by a single dominant gene, the other, type B, genetically complex. In type A plants homozygous for resistance it is impossible to induce the disease, but in the case of type B, which cannot be fixed by repeated selection, the reaction varies with temperature, all plants being susceptible at 22°–24°C. Thus type A plants can be selected by raising the soil temperature to 24°C. All collections of the parasite have been found to act alike in respect of their pathogenic properties.

The host-parasite relation shews corresponding behaviour in the two types. In both at low temperatures infection is confined to the root cortex, but at higher temperatures in type B, the fungus penetrates the root to the xylem as in susceptible plants ; in type A the behaviour is constant over a wide range of temperatures.

662. ANDERSON, M. E. and WALKER, J. C. 635.34–2.484–1.521.6:581.43
Histological studies of Wisconsin Hollander and Wisconsin Ballhead cabbage in relation to resistance to yellows.
J. Agric. Res. 1935 : **50** : 823–36.

Morphological studies of infection by *Fusarium conglutinans* Wr. were made in a susceptible strain of the Hollander cabbage, in Wisconsin Ballhead, whose resistance to the fungus is determined by a single dominant factor, and in Wisconsin Hollander, whose resistance is intermediate and is not determined by a single factor.

No definite morphological differences could be observed between the two resistant types of cabbage, and the difference between the two types of resistance appears to be one of degree rather than of kind.

It is suggested that the biochemical method would provide the best approach for a further attack on the problem.

663. RUDORF, W. and STELZNER, G. 635.52:581.143.26.03
Untersuchungen über lichtperiodische und Temperaturnachwirkung bei Sorten von Salat (*Lactuca sativa* var. *capitata* L.) und die Möglichkeit ihrer Ausnutzung im Gemüsebau. (Vorläufige Mitteilung.) [**Investigations on the photoperiodism and reaction to temperature of varieties of lettuce (*L. sativa* var. *capitata* L.) and the possibility of their utilization in horticulture. (Preliminary contribution.)**]
Gartenbauwiss. 1934 : **9** : 142–53.

The following experiments were undertaken with a view to the improvement of lettuces by increasing the time during which they are of market value.

Varieties for forcing and winter and spring varieties were used, two typical kinds of each, and were sown at the end of June, some with a normal light period of 16½ hours, others with 12 and 8 hours light periods respectively for 12 and 24 days. A series grown for 14 days in complete darkness, died.

The two spring varieties and one winter variety proved to be uninfluenced by changes in the light period. In the other varieties the short day noticeably decreased bolting in the plants. It was also found that there was a considerable increase in size and weight in the plants grown under short-day conditions.

In practice, therefore, the young plants should be grown under short-day conditions so as to increase the length of time when they are of market value.
Experiments were also made on the effect of temperature. Seed of all the varieties was germinated at 25°C. and the seedlings then grown for 10 days at either −5°C. or +5°C. in the dark. Treatment at −5° led to a marked increase in the fresh weight and marketing value of the plants in all except one variety.

664. 635.621:575.127.2:635.624
LI, H. W. 635.62:576.354.4:575.11
Cyto-genetical studies of the cross between the squash (*Curcurbita maxima*, Duch.) and pumpkin (*C. pepo* L.).
Agric. Sinica 1935 : **1** : 151–74.
A few F_1 plants were obtained from the cross squash x pumpkin ; they produced very few viable pollen grains and were self-sterile, but set seed when back-crossed to either parent.
Meiosis shewed irregularities such as precocious separation and lagging of chromosomes with resultant formation of micronuclei, and in some cases a certain amount of failure of pairing. Similar behaviour was found in the back-cross progeny.
Studies were made on the inheritance of a number of characters ; for shape indications were obtained of a single pair of major factors operating without dominance, while for leaf lobe shape simple Mendelian segregation was found with pointed leaves dominant over round.

665. LESLEY, M. M. and LESLEY, J. W. 635.64:576.312.34:576.312.315
Heteromorphic *A* chromosomes of the tomato differing in satellite size.
Genetics 1935 : **20** : 568–80.
In material of four wild species of *Lycopersicum* and of three cultivated varieties of tomato, the *A* chromosomes had short satellites, but in certain experimental material *A* chromosomes with long satellites appeared. In the hybrid between a race with two long satellites (" long long ") and one with two short (" short short "), one *A* chromosome had a long satellite and the other a short one (" long short "). In F_2 the three types appeared in proportions not differing significantly from the expected 1 : 2 : 1.
The behaviour of the two types of chromosome in somatic and meiotic divisions is described. The *A* chromosome is associated with the nucleolus and in " long short " plants, when two nucleoli appear in somatic cells one is large and the other small, indicating some correlation between satellite size and nucleolus size. The satellites lie out of the plate in somatic metaphases and lag at anaphase. At pachytene they are usually unpaired and at diakinesis they cannot be distinguished.
The origin of the extra material in long satellites is unknown, but evidence is given suggesting that it is genetically inert ; the two types of *A* chromosomes are apparently homologous and do not associate with any other chromosome.

666. ALEXANDER, L. J. 635.64–2.484–1.521.6:575
Progress in the development of a new leaf mold resistant tomato variety.
Proc. 20th Ann. Meet. Ohio Veg. Grow. Ass. 1935 : 25–27.
From the progeny of two exceptional plants found in greenhouses and shewing resistance to leaf mould, by crossing with commercial varieties and repeated back-crossing, resistant plants have been obtained from which it is hoped that commercially desirable forms will be obtained.
The exceptional plants mentioned, which had very small fruits and coarse growth, closely resemble the progeny of a cross between the so-called Red Currant tomato (*Lycopersicum pimpinellifolium*) and the commercial variety Globe ; it is suggested therefore, that they arose from a chance cross between these forms.

667. PIERCE, W. H. 635.65–2.8–1.521.6:575
The inheritance of resistance to common bean mosaic in field and garden beans.
Phytopathology 1935 : **25** : 875–83.
A study of the F_1 and F_2 generations from a number of crosses and their reciprocals made with the varieties Corbett Refugee, Robust, Great Northern UI No. 1 and Refugee Green, the first three being homozygous for resistance and the last for susceptibility.
All F_1 Corbett Refugee hybrids were resistant to common bean mosaic, while the F_1 from Great Northern UI No. 1 x Refugee Green and from Robust x Refugee Green were susceptible.
Certain resistant varieties on crossing gave susceptible plants in F_2.
Since Great Northern UI No. 1 and Robust did not segregate in F_2, the resistance of these two varieties is probably similar.
Idaho Refugee and Wisconsin Refugee (both homozygous for resistance and obtained from a Refugee Green x Corbett Refugee cross) were found to have the same degree of resistance as Corbett Refugee. The latter consistently shewed a dominant type of resistance.
Owing to the differences observed in certain reciprocal crosses a factorial explanation is not attempted, since the inheritance of resistance may be partly non-Mendelian.

668. NEMEC, B. 635.651:575.255:575
Grösse und Form der mixoploiden Organogene. (**Size and form of mixoploid organ formations).**
Proc. 6th Int. Bot. Congr. Amsterdam 1935 : **2** : p. 119.
By repeated treatment of plant roots with chloral hydrate chimaeras of the lateral roots were obtained with polyploid sectors and were of three kinds : (1) Externally normal (i.e. with a circular cross section) ; (2) With sectors clearly protruding in a radial direction beyond the normal diploid parts and longitudinally fluted externally ; and (3) Externally marked by irregular longitudinal swellings which bore no relation to the polyploid condition.
These three types of characterization are stated to be apparently heritable. In the first group the actual size of the organ is inherited and the polyploid sectors have the same diameter as the diploid ones. In the second group cell size is transmitted so that polyploid sectors have also a greater radial diameter. The third group has an irregular form of the root section.
A process of elimination of the polyploid sector may occur if it extends to the periphery of the root and lateral roots originally mixoploid revert again to the purely diploid state.

669. 635.651:581.48:575.11–183
SOSA-BOURDOUIL, C. 635.651:581.13:575
Recherches physiologiques sur les parents et les hybrides de fève (*Vicia faba* L.) [**Physiological investigations on the parents and the hybrids of the bean (*V. faba* L.).**]
C.R. Acad. Sci. Paris 1935 : **200** : 1236–38.
V. Faba var. *major* x *V. Faba* var. *minor* whose seeds averaged 1·31 and 0·43 g. respectively in weight gave F_1 hybrids whose average seed weight approached that of the ♂ parent while in F_2 the average weight per seed was intermediate between that of the parents i.e. 0·978.
Analyses of the nitrogen content and the carbohydrates shewed (a) that in the proportions of nitrogen the F_2 might either resemble either parent or be intermediate and (b) that carbohydrate synthesis was very similar in the two parents and had been but little altered in the hybrid.

670. MALINOWSKI, E. 635.652:575.125:581.143.26.035.1
Studies on hybrid vigour in *Phaseolus vulgaris* (L.) Savi. Part I. Vigorous sizes and photoperiodic response of the F_1 plants.
Z. indukt. Abstamm.-u. VererbLehre 1935 : **70** : 96–124.
Two varieties of *P. vulgaris, oblongus albus* (Inexhaustible bean) and *oblongus melleus* grown as pure lines, were used in the crosses. The seeds of the F_1 shewed a range of variation from dark brown to black, mottled with yellowish brown in marked contrast to the yellow and white seeds of the parent forms. Seed size and flower size were intermediate but heterosis was shewn in the

height of plants, length and number of internodes, number of branches and sizes of leaves and pods. The F_1 began to flower at the same time as the later parent but the maximum intensity of flowering occurred much later than either of the parental forms.
There was also a considerable increase in yield in the F_1.
A cytological examination shewed normal reduction divisions. Both parent forms have 11n chromosomes.
F_1 plants were exposed to 8 hour periods of daylight with the result that in comparison with normal plants there was a marked decrease in all vegetative characters. The seeds however were significantly larger in the treated than in the untreated plants.
The opposite effects on the plant characters of heterosis and short day treatment respectively are pointed out.

671. 635.652:581.48:575.247
IMAI, Y. 635.656:581.48:575.247
Recurrent pseudomutation.
Amer. Nat. 1935 : **69** : 456–59.
Mottled seed coat pattern in *Phaseolus vulgaris* is dominant to self-coloured. The mottled seeds in a population of the Nagauzura strain contained 4·09 per cent pseudo-red seeds and the plants grown from either the mottled or the pseudo-red seeds gave the same proportions of mottled and pseudo-red seeds. The phenomenon is ascribed to recurrent pseudo-mutation which gives rise to mottled seed coats if it occurs late in the development of the seed coat, to pseudo-red if it occurs early.
A similar phenomenon in the seed coats of *Pisum sativum* is explained in the same way.

672. 635.652–2.452–1.521.6
HARTER, L. L., 635.653–2.452–1.521.6
ANDRUS, C. F. and ZAUMEYER, W. J. 632.452:576.16:635.652
Studies on bean rust caused by *Uromyces phaseoli typica*.
J. Agric. Res. 1935 : **50** : 737–59.
The susceptibility of a number of varieties of beans (*Phaseolus* spp.) to bean rust, (*Uromyces phaseoli typica* Arthur) was determined by field and greenhouse experiments.
Two physiological forms, named forms 1 and 2, were discovered, form 2 being more virulent, while form 1 is the more widely distributed.
Breeding resistant forms appears to be the most promising method of control of the disease.

673. NISIKADO, Y. and YAMAUTI, K. 635.8:577.81
Studies on the heterothallism of *Cortinellus Berkeleyana* Ito et Imai, an economically important edible mushroom in Japan.
Ber. Ōhara Inst. 1935 : **7** : 115–28.
An investigation of sexuality in *Cortinellus Berkeleyana* Ito et Imai, one of the most important edible mushrooms in Japan. Heterothallism was demonstrated and four sexual groups were found.

06(058)(43.91)

Magyar Minerva.

Királyi Magyar Egyetemi Nyomda, Budapest, 1932 : (1930–31) **6** : 25 pengö. Pp. 976.

The first 692 pages of this reference book, which contains much information which might be obtainable only with difficulty elsewhere, comprise descriptions in Hungarian of the educational and scientific institutions, libraries and museums, etc. of Hungary. The names of the various institutions are given in Hungarian, German and French in this section and in the supplementary section (pages 703–976) the more important of them are described in German.

Appended are indexes of the institutions classed under subjects as well as indexes of the names of the various persons cited.

JENNINGS, H. S. 575.1

Genetics.

Faber and Faber Ltd., London 1935 : 15*s*. Pp. 351. 70 illus.

Though this book does not appear to have been written especially for the " man in the street," assuming as it does a fair acquaintance with biology on the part of the reader, there is no doubt that it could serve as an introduction to the science of genetics for the layman.

The plan of the book is interesting, the first 108 pages being devoted to sex inheritance and related phenomena ; only when the behaviour of chomosomes and its correlation with genetical phenomena has thus been illustrated is the reader introduced to autosomal segregation and the gene. Thereafter the various complexities of genetics are treated, always in terms of the gene.

As the book is based on animal genetics many of the phenomena of special importance to plants are dealt with only briefly.

WATKINS, A. E. 575.1:576.12

Heredity and evolution.

John Murray, London, 1935 : 7*s*. 6*d*. Pp. viii + 243. 25 figs. 2 pls.

Written for the student or popular reader, this new volume on evolution presents the basic facts of genetics in simple and readable language, not quite in the way they are usually presented in textbooks of Mendelism, but selecting and emphasizing those aspects that have a bearing on evolutionary theory. In this way Mendel's laws, the theory of variation and pure lines, cell division and its genetical effects, polyploidy and the origin of polyploid series are reviewed by reference mainly to familiar examples. The more complex and controversial aspects are usually omitted for the sake of clearness.

The more directly evolutionary problems of mutation, selection, mimicry and the species concept are treated last, somewhat more fully. Special attention is given to the theories of natural selection, the Age and Area Theory of Willis and its more modern counterpart, Vavilov's theory of origin and distribution of cultivated plants. Willis's theory, just as the theory of natural selection, is shewn to be insufficient to explain the facts. Evolution can be explained only by a combination of the two opposing principles of variation and selection. To quote the author " Species exist chiefly because the causes responsible for the differences between one individual and another are of various kinds, with effects of varying size, so that there seem to be groups with gaps between them ; the distinction between these groups being accentuated because certain kinds of difference are specially likely to prevent successful mating." The differences between species often arise at a single step, by what the author styles " species mutations," as in the origin of polyploids, which almost always results in a specific difference. " We now know that species are in large part a reflection of the different kinds of variation that may occur, and that sometimes, indeed, they orginate through a single large genetical change." The accumulation of small differences is not denied a possible role however in the origin of species, though it has yet to be proved. It is also pointed out that few if any factor mutants so far observed have proved at all beneficial or progressive and it is thought that undue emphasis has been placed on the necessity for large numbers of new mutants to explain evolution. " It may be," the author states in his conclusions, " that the actual production of new genetical factors is a rare event,

states in his conclusions, "that the actual production of new genetical factors is a rare event, especially in higher organisms; and that a limited number of factors can build up more and more new forms of life by reduplication and re-arrangement, diversification being assisted by factor mutation of the family kind."

The most valuable contribution of the book lies in the succinct and unbiassed summing-up of the present position of the evolution theory given in the "Conclusion." Appropriate references to literature in English are appended to the various sections and a glossary is provided for the uninitiated.

KÜSTER, E. 576.3

Die Pflanzenzelle. Vorlesungen über normale und pathologische Zytomorphologie und Zytogenese. (**The plant cell. Lectures on normal and pathological cytomorphology and cytogenesis**).

Gustav Fischer, Jena 1935: Unbound RM. 34, bound RM. 36. Pp. xii + 672. 323 figs.

These lectures represent a comprehensive survey not only of the morphology of the living plant cell but also of its various inclusions and its secretions as manifested by the different types of cell membranes found in plants and finally of the development of the cell in its various forms. The work is divided into 7 sections dealing with the protoplasm, the nucleus, the plastids, the vacuoles, the starch grains, crystals and other non-living cell inclusions, the membranes and lastly the development of the cell. The section on the nucleus includes its normal and abnormal manifestations. Cell division is described in its main outlines but not the more detailed structure of the chromosomes, and the modern chiasma theory is not discussed. The literature is very fully reviewed, and a list of titles is conveniently given at the end of each section and even work published in 1935 is included. The work is well and fully illustrated.

PEACOCK, H. A. 578.6

Elementary microtechnique.

Edward Arnold and Co., London 1935: 5*s.* 6*d.* Pp. vii + 200. 15 figs.

This little book should prove useful to those taking up microscopical work and would serve as an admirable introduction to the more advanced works on the topic.

In chapters I-IV the principles and fundamentals of fixing, cutting, staining, mounting, etc., are treated, the rest of the book being devoted to methods for specific purposes, uses of stains, and formulae and hints, all arranged alphabetically for convenience in reference. There are also useful appendices on the sources and preservation of material, a short bibliography and an index.

58

LEACH, W. 578.08

A textbook of practical botany for Intermediate and Higher School Certificate students.

Methuen and Co., Ltd., London 1935: 4*s.* Pp. x + 160. 23 illus.

A laboratory manual covering the practical work in the syllabus for Higher School Certificate, with the exception of the study of the families of angiosperms, it being considered that this work is already understood by students who have studied botany up to matriculation standard. After a preliminary chapter on reagents, the microscope and its use, section cutting and botanical drawings, the study of the structure of plants is dealt with. This is divided into 31 schedules, beginning as usual with the anatomy of the flowering plants and then working systematically through the other groups; this section is illustrated by some very fine photomicrographs. There follows a chapter on the identification of plant material and then a series of elementary experiments in plant physiology.

Appendices are provided on the preparation of permanent mounts and a list of the material required for the anatomical work, the utility of the book being enhanced by a comprehensive index.

SMITH, G. M., OVERTON, J. B., GILBERT, E. M., DENNISTON, R. H., BRYAN, G. S., and ALLEN, C. E. 58 575.1

A textbook of general botany.

The Macmillan Company, New York, 1935 : 15*s.* 0*d.* Pp. x + 574. 429 figs.

A carefully written American textbook designed for a year's course in botany. The book does not display the unevenness that might be expected in view of its numerous authors and covers a wide syllabus with considerable thoroughness. The plan of the book is slightly different from the usual, but a more conspicuous deviation is the very sparing use of technical terms, in spite of which, it must be said, the inaccuracies are less than usual in elementary textbooks.

In the chapter on " Inheritance and Variation " the various types of chromosome and gene mutations are dealt with as well as mono- and dihybrid segregation and linkage and crossing-over. It is noteworthy that the diagrams to illustrate crossing-over shew partial chiasmatypy. The following chapter deals with evolution and in other chapters somatic and meiotic nuclear divisions are described. The book ends with a chapter on the economic uses of plants.

58
SWINGLE, D. B. 575.1

Plant Life. A textbook of botany.

Chapman and Hall, Ltd., London 1935 : 15*s.* Pp. xiv + 441. 290 figs.

An American elementary text book designed for a course of botany lasting one semester. The book covers a fairly wide syllabus, the functional point of view being kept to the fore throughout. In the part headed " Plants past and present " the elementary principles of heredity and various theories of evolution are given a brief treatment.

The author's treatment of technical terms deserves mention. They are italicized when first used and at the end of the book there is a glossary which, however, is descriptive rather than definitive.

584.2:576.12
CHAMBERLAIN, C. J. 634.975

Gymnosperms. Structure and evolution.

The University of Chicago Press, Illinois, 1935 : 21*s.* 0*d.* Pp. xi + 484. 397 figs.

To those who are acquainted with his earlier works, any new contribution on the gymnosperms by Dr. Chamberlain will be welcome. The present book may be said to compress a life's work within some 450 pages and will be indispensable to those studying the group.

Though interesting in many ways, the gymnosperms are probably most important in their relation to evolution and the author makes shrewd use of the evolutionary point of view to bring order into the mass of facts which go to make this book.

Both living forms and fossils are dealt with, full recognition being given to the work of English palaeobotanists in connexion with the latter. The whole group is broken into two main divisions, the Cycadophytes comprising the Cycadofilicales (seed-ferns), Bennettitales and Cycads, and the Coniferophytes comprising the Cordaitales, Ginkgoales, Coniferales and Gnetales. The main part of the book is devoted to the comparative morphology and life histories of the various forms, a good deal of attention being devoted to cytological aspects ; at the end there are two stimulating chapters on phylogeny and the alternation of generations and the book concludes with an extensive bibliography of over 700 references and an index.

585.421(54.7)
BLATTER, E. and MCCANN, C. 633.1(54.7)

The Bombay grasses.

Sci. Monogr. Coun. Agric. Res. India 1935 : No. 5 : 32*s.* 6*d.* Pp. 324. 189 illus.

A monograph dealing with the wild and cultivated grasses found in Bombay. Under each species is given a list of synonyms, its vernacular names, the etymology of its Latin name, the localities where it has been reported, the type of habitat, its world distribution and its economic uses if any. The localities of the indigenous forms are also tabulated at the end of the book.

There are 189 excellent illustrations, an extensive bibliography and an index of Latin names.

631.42
519.2

WISHART, J. and SANDERS, H. G.

Principles and practice of field experimentation.

Emp. Cott. Grow. Corp. London 1935: 3*s*. 0*d*. Pp. 100. 32 tables.

The importance of statistical methods in agriculture to-day does not need to be stressed. This book, which is used as the textbook for the course in Field Experimentation in the Cambridge University School of Agriculture, should prove invaluable to those desiring a concise and authoritative account of the subject.

In the first part, entitled " Principles," the necessary modern statistical methods are treated, starting with the t and z tests and proceeding to the analysis of variance, with its modifications such as randomized blocks, the Latin square, multiple factor experiments, and the analysis of covariance. No attempt is made to describe all the methods which are or have been used, but only those which the authors consider necessary. Tables of t and z are reproduced from Fisher's " Statistical Methods for Research Workers."

The second part, dealing with practical considerations, is the complement of the first and seeks to shew how the principles of replication, randomization and local control to reduce experimental error are applied in practice.

The book as a whole deals, as its title indicates, with principles rather than with a standardized method, and should therefore be of service to agricultural workers in general, and of course to plant breeders in particular.

631.421
519.24

FISHER, R. A.

The design of experiments.

Oliver and Boyd, Edinburgh and London, 1935: 12*s*. 6*d*. Pp. xii + 252. 39 tables.

The appearance of a new book by the author of " Statistical Methods for Research Workers " will be heartily welcomed. An important part of the earlier work was the section dealing with agricultural experimentation, which described the methods worked out by the author at Rothamsted and now widely known. Extension of this work has made a new book desirable, for, as the author says, " the design of experiments is . . . of too great importance to the general body of scientific workers for any incidental treatment to be adequate." The result is a work in which the mathematical attitude towards inductive inference and the principles of experimentation (the " logic of the laboratory ") are admirably expounded, first by means of certain quite simple experiments, and later through some very elaborate and complex trials which have been put to the test in agricultural experimentation, although the principles are general.

Although self-contained as an exposition of principles, the book will only be fully appreciated by those who are familiar with the author's earlier work, or who read it concurrently with the present one. For details, in fact, of the purely statistical methods involved, the reader is repeatedly referred back, as also to the tables necessary for testing significance. Not much that is new is added to what we know of the simple " randomized blocks " and " Latin Square " methods beyond the section on " Graeco-Latin and Higher Squares," but the re-statement of principles, and the careful and precise wording, are most valuable for a thorough understanding of the methods. The arithmetical examples provided are left for working to the reader. It may be doubted whether 71 pages dealing with factorial design and confounding, compared with 20 pages on the methods that are commonly referred to as " analysis of covariance," is the right proportion, yet it is valuable to have put together the elaborate methods that have been the subject of discussion of many scattered research papers. The treatment of " covariance " might with advantage have been fuller, for the method has undoubtedly " caught on," both in this country and in America, and it is important that workers should have a guide to the correct methods—methods which, while carrying out the experimenter's intentions provide him at the same time with a test of how far their application has justified itself.

A final chapter on " the measurement of amount of information in general," in which the author is riding his favourite steed, should be of particular value to geneticists in the further treatment provided of linkage problems. The book should find a place as a working manual in every experimental laboratory, and it will have justified itself if it leads to a better recognition of the more general applicability of methods originally devised for use in one particular branch of biology.

J. W.

WOLLENWEBER, H. W. and REINKING, O. A. 632.484
Die Fusarien, ihre Beschreibung, Schadwirkung und Bekämpfung. (**The *Fusaria*, their description, pathogenic action and control.**)
Paul Parey, Berlin 1935 : Unbound RM. 18, bound RM. 20. Pp. viii + 355. 95 illus.

Over six hundred forms of *Fusarium* have been described—on as many different hosts—and this, combined with the difficulties of obtaining the fruiting stage and of accurate classification, has led to considerable confusion in the genus as a whole. The present authors have succeeded in eliminating a number of the existing synonyms and by limiting the genus to forms with sickle-shaped spores have still further reduced its range. Their classification is based entirely on the conidial characteristics, though indications are given whenever possible of the Ascomycetes which have similar or identical conidial formation.

The systematics of the genus are first dealt with, keys to all sixteen groups being provided. Descriptions and illustrations are then given of the typical forms and of the corresponding mycelial forms, with indications of the existing synonyms.

The remaining half of the book is devoted to the parasitology of *Fusarium*, its various plant hosts being dealt with in turn, arranged alphabetically according to their Latin names, and including crop plants, horticultural plants and ornamentals. Appropriate references to the literature are given after each plant. There follow short sections on the forms parasitic on other organisms such as animals and mushrooms and those living in the soil, milk, water, etc.

The volume terminates with a list of the synonyms and homonyms of the forms belonging both to *Fusarium* and to the corresponding mycelial forms *Nectria*, *Calonectria*, *Gibberella* and *Hypomyces*, including also certain forms now removed altogether from this group into other genera.

The work provides a valuable reference book for anyone who has to deal with this confused and confusing group of parasites.

BECKER-DILLINGEN, J. 633-1.8
Handbuch der Ernährung der landwirtschaftlichen Nutzpflanzen. (**Handbook of the nutrition of agricultural economic plants**).
Paul Parey, Berlin, 1934 : RM. 19.60. Pp. viii + 523. 124 figs. 12 pls.

The success of the author's previous work on the nutrition of horticultural plants (Cf. " Plant Breeding Abstracts," Vol. III, p. 224) has prompted the issue of a companion volume for agricultural plants. General problems of the physiology of nutrition, the soil and manuring are dealt with in the first three parts, the fourth is devoted to the special needs of those economic crops, individually treated, which are grown in Germany. These include the cereals, legumes, root crops, oil-producing plants, fibre plants, hops and tobacco, forage and herbage plants and pastures. The volume is admirably illustrated with coloured plates, photographs and diagrams.

ZUHR, E. 633.1:581.11:581.48
Über die Wasseraufnahme und Wasserabgabe des reifen und reifenden Getreidekornes in sortenkundlicher Hinsicht. (**On the water absorption and water loss of the ripe and ripening grain of cereals from a varietal point of view**).
Carl Gerold's Sohn, Wien and Leipzig 1933 : RM. 5 : Pp. 126. 45 tables.

A study of the behaviour of the grain of the different cereals with regard to absorption and loss of water during the ripening period. The author shews that the quantity of water taken up by the swelling grain is a varietal effect, as is also the rate of water loss by the swollen grains.

The work includes a detailed study of the behaviour of the grain with respect to water during ripening and a special section is devoted to a study of the water loss of the ripening wheat grain. Varietal effects were found, which, however, were considerably modified by the locality in which the plants were grown.

SNELL, K. and GEYER, H. 633.491(43)

Die Kartoffelsorten der Reichssortenliste, ihre Erkennung, Unterscheidung und wirtschaftliche Bewertung. (**The potato varieties of the official variety list, their recognition, distinction and economic evaluation**).

Paul Parey, Berlin 1935 : RM. 1.80. Pp. 80. 30 illus.

The official variety list drawn up by the State food board comprises 66 varieties which are permitted to be sold for seed : of these 28 are only provisionally included either because they need further testing or because they are not wart-immune. After 1940 no wart-susceptible varieties will be allowed on the list. New varieties will only be included if after stringent tests they shew themselves markedly superior to existing varieties, which they will displace.

After explaining the method used in describing potato varieties, the authors give descriptions of the 66 varieties on the list, mentioning also their origin, the breeders from whom they are obtained, their economic qualities and their reactions to certain diseases.

There is also a list of varieties which must not be put on the market after 1936.

KIOK, W. 633.682:581.9:581.6

Der Maniok. Ein Beitrag zur Wirtschaftsgeographie der warmen Länder. (**Manioc. A contribution on the economic geography of warm countries.**)

PhD. Dissertation, Ernst-Moritz-Arndt-Universität, Greifswald. Carl Goldammer, Lauban 1934 : Pp. 64.

The first section of this pamphlet contains a concise description of *Manihot utilissima* Pohl from the botanical and agronomic standpoints with comments on the economic uses of the different varieties. The second part deals with statistical data on manioc cultivation in America, Africa, Indo-Malaysia, Australia and Oceanea.

Part 3 contains brief comments on manioc cultivation with reference to climate and on production, imports and exports.

A classified bibliography with a number of maps concludes the pamphlet.

633.74(063)

Conférence Internationale du Cacao, Bruxelles, 12, 13 et 14 septembre 1932. Compte rendu officiel. (**International Conference or Cacao, Brussels 12, 13 and 14 September 1932. Official report**).

Minist. Affaires Etrangères, Belgique 1932 : Pp. 171.

A full report of the minutes and proceedings of this conference convened by the Belgium Government at the instance of the International Office of manufacturers of chocolate and cocoa at Brussels and attended by official delegates from countries directly or indirectly interested in the production of cocoa beans. The conference dealt mainly with the financial and economic aspects, development of cocoa production and propaganda to encourage consumption. The establishment of an international fund for these objects and also to encourage scientific research towards these ends was considered.

635.9(67.6)

Gardening in East Africa. A practical handbook by members of the Kenya Horticultural Society and of the Kenya and Uganda Civil Services.

Longmans, Green and Co., London, 1934 : 12*s.* 6*d.* Pp. xv + 330. 6 pls. 6 figs.

This volume has been prepared by members of the Kenya Horticultural Society and is described on the cover as " a practical handbook for amateur gardeners living in subtropical climates." The book certainly lives up to this description. Such subjects as climatic conditions, soils, and manuring, which are of fundamental importance to the gardener, are admirably dealt with by scientific experts of the Kenya and Uganda Civil Service. Separate chapters are devoted to the different types of plants grown in gardens, all written by enthusiasts. The descriptions, likes and dislikes of individual plants are brief and practical, and with this volume at hand no gardener in a subtropical country should go very far wrong in his choice of what to grow. As Sir Arthur Hill very aptly remarks in his foreword, " the sting of the book is in its tail." He is referring to

the chapters on the pests and diseases with which the subtropical gardener has to contend, but valuable practical hints are given as to methods of control.

To an English gardener, with no experience of sub-tropical gardening, this book gives a delightful insight into conditions of living in such a country. It is difficult to realize that wallflowers cannot be grown in Kenya, that rose gardens have to be fenced six feet high to avoid damage by bucks, and that porcupines may demolish a whole bed of gladiolus corms. Added to that, the possibility of waking up one morning and finding one's garden washed away seems to make gardening a more adventurous hobby than at home.

That such a practical handbook as this should at the same time provide such interesting reading is but one proof of its merits. It should be invaluable to those who will have an opportunity of putting its recommendations into practice. R. E.

NEW JOURNALS

East African Agricultural Journal.

The predecessor of this journal was discontinued in 1914, and since the War the need for a new journal has been repeatedly urged. The East African Agricultural Journal is to fulfil that need. It is published every other month, is well printed and illustrated and deals with agricultural topics pertaining to East Africa. In the first two numbers there are several articles of interest to plant breeders, some of which are reviewed in the present number of " Plant Breeding Abstracts," while a series of articles on plant virus diseases in East Africa should add considerably to our knowledge of this rapidly growing field of biology. (Edited by : W. Nowell, Director of the East African Agricultural Research Station, Amani, via Tanga, Tanganyika Territory. Published every other month, commencing January. Subscription 5/- per annum, or 1/- per copy).

Journal of the British Honduras Agricultural Society.

The British Honduras Agricultural Society has produced this journal for members and others. It is published quarterly and contains articles on topics of interest to planters in British Honduras as well as news items, market reports, extracts from other journals and other similar features. (Published by : British Honduras Agricultural Society. Quarterly. Annual Subscription, including Membership of the Society : Colony $1.00, Abroad $1.25. Non-Members (single copies) 25 cents.)

Palestine Journal of Botany and Horticultural Science.

Though there are published in Palestine journals for the agricultural public (the Hebrew periodical " Hassadeh ") and for those concerned with citrus fruits (" Hadar "—bilingual), this is the first journal to be published in that country devoted to research in Botany and Horticultural Science. As the editor points out in his introduction Jews have in the past made important contributions to botanical science, such names as W. Pfeffer, N. Pringsheim and E. Strasburger being mentioned, and so this new vehicle of expression of what is practically a new country should not lack material.

The journal is to be published at irregular intervals, the articles being written in European languages, and though primarily intended for the publication of research done in Palestine, will not exclude works by foreign authors.

The first number contains various physiological articles, a review of research in Palestine and an article on *Cuscuta monogyna* as a horticultural parasite. (Agent : W. Junk, Den Haag, Holland Scheveningsche Weg 74. Published three times a year at irregular intervals).

INDEX

Aamodt, O. S., 328
Abraham, P., 356
Akemine, T., 457, 540
Åkerman, Å., 490
Alexander, L. J., 666
Alexeyev, B. P., 470
Ali Mohammad, 346
Allen, C. E., p. 206
Anderson, E. G., 539
Anderson, M. E., 662
Andersson, G., 555
Andrus, C. F., 672
Anonymous, 314, 324, 325, 348, 363, 366, 369, 376, 394, 398, 424, 429, 431, 442, 480, 526, 584, 588, 601, 639, 641, 649, p. 204, p. 209
Anson, R. R., 352

Backman, E., 454
Bailey, S. F., 660
Balls, W. L., 350
Barbee, O. E., 523
Bartlett, M. S., 317
Bayles, B. B., 492
Beadle, G. W., 538
Beaumont, A. B., 657
Becker-Dillingen, J., p. 208
Beckett, R. E., 619
Bell, A. F., 373
Benincasa, M., 596
Berrigan, D., 621
Biffen, R. H., 494
Bigger, J. H., 552
Bjaanes, M., 502
Blatter, E., p. 206
Boekholt, K., 511
Boerger, A., 499, 519
Bogdanov, P. L., 651
Bolgareff, P. T., 650
Bolsounov, I., 598
Bonne, C., 593
Bose, R. D., 331
Böttger, St., 593
Bougy, E., 592
Bourne, A. I., 657
Bourne, B. A., 586
Brady, J., 312
Brandscheidt, P., 648
Braunroth, E., 486
Brétignière, M. L., 425
Brieger, F. G., 541
Brierley, W. B., 316
Briggs, F. N., 557
Broekema, J. C., 427
Brown, C. H., 353
Brown, H. D., 656
Bryan, G. S., p. 206
Burr, S., 404

Câmara, A. de Sousa da, 508
Cameron, C., 378
Chalaud, G., 495
Chamberlain, C. J., p. 206
Chiarugi, A., 468
Chiritescu-Arva, M., 599
Chodat, F., 642
Clark, J. A., 492, 498
Clark, J. H., 640
Clarke, A. E., 539
Clay, S., 409
Cleland, R. E., 462
Coe, F. M., 625
Cook, G. E., 623
Corner, E. J. H., 327
Cramer, P. J. S., 395
Cross, W. E., 587

Darlington, C. D., 319, 458
Darrow, G. M., 638
Davidson, W. D., 573
Défago, G., 475
Denniston, R. H., p. 206
Desprez, F., 517
Deuss, J. J. B., 610
Dicus, A. L., 536
Doran, W. L., 657
Draghetti, A., 516
Duncan, G. H., 552
Dutt. N. L., 364, 365

East, E. M., 446, 604, 605
Edgerton, C. W., 585
Emsweller, S. L., 660
Euler, H. v., 554
Evreinoff, V. A., 622, 627

Feldstein, M. J., 435
Fischer, A., 569, 570
Fisher, R. A., 438, p. 207
Flint, W. P., 552
Flovik, K., 436
Follet-Smith, R. R., 378
Folloni, A., 496
Forster, H. C., 321
Frandsen, H. N., 426
Frankena, H. J., 471
Frimmel, F., 644, 645

Gaertner, T. von, 486
Gandhi, S. R., 399, 400
Geyer, H., p. 209
Ghimpu, V., 481
Gilbert, E. M., p. 206
Gilmour, J. S. L., 318
Good, R., 318
Goytia y Angulo, M. de, 501
Grábner, E., 417
Guinier, P., 653
Gunnery, H., 396
Gustafsson, C. E., 637
Gutierrez, M. E., 602

Hagar, W. S., 574
Haldane, J. B. S., 317
Hall, D. M., 549
Hansford, C. G., 359, 374
Hariharan, P. V., 332
Harter, L. L., 672
Hawthorn, L. R., 659
Hellström, H., 554
Hersh, A. H., 435
Heuser, W., 511, 527
Higgins, B. B., 633
Hill, A. G., 372
Holbert, J. R., 552
Honecker, L., 556
Horovitz, S., 543
Hosono, S., 504
Hudson, P. S., 463
Hülsenberg, H., 594
Humphrey, L. M., 537
Huntington, E., 545
Hutchinson, J. B., 315, 357, 358, 581

Imai, Y., 567, 671
Ivanišin, I. A., 466

Janaki Ammal, E. K., 405
Jannaccone, A., 464
Jenkins, M. T., 546
Jennings, H. S., p. 204
John, C. M., 390
Johnson, G. F., 574
Jones, D. F., 545
Jones, H. A., 660

Kadam, B. S., 333, 339
Kaden, O. F., 614, 616
Kaiser, S., 617
Kappert, H., 582
Kashi Ram, 380
Kattermann, G., 505
Kerle, W. D., 544
Kessler, W., 483
Khadilkar, T. R., 343
Khanna, K. L., 377
Kiener, W., 654
Kihara, H., 503
Kiok, W., p. 209
Kočnar, K., 418
Koenig, P., 597
Kohls, H. L., 591
Kokuev, V. I., 580
Kolmogorov, A., 414
Konold, O., 422
Kostecki, E., 423
Kostoff, D., 455, 606
Kraevoi, S. Ja., 620
Krishnaswami, N., 335, 406
Kristensen, R. K., 412
Krug, C. A., 612
Kunhi Krishnan Nambiar, K., 407, 408
Küster, E., p. 205
Kvaran, P., 529

L(eake), H. M., 371
La Cour, L., 453
Langlet, O., 655
Larter, L. N. H., 402
Lathouwers, M. V., 515
Latzke, E., 621
Lawrence, W. J., C., 459
Leach, W., p. 205
Lecat, M., 528
Lesley, J. W., 665
Lesley, M. M., 665
Li, H. W., 664
Lindschau, M., 507
Lindstrom, E. W., 534
Lock G. W., 326
Löfgren, N., 554
Love, H. H., 415

McCann, C., p. 206
McCleery, F. C., 311
McClintock, B., 531

McDonald, I. M., 595
McIntosh, A. E. S., 367, 368, 375
McMillan, J. R. A., 329
Magruder, R., 659
Malinowski, E., 670
Malpeaux, L., 589
M(anglesdorf), A. J., 583
Mann, C. E. T., 393
Marsden-Jones, E. M., 318
Matsushima, K., 565
Mehta, T. R., 313
Merjanian, A., 647
Meurman, O., 440
Mills, P. J., 585
Milner, R. T., 330
Mitscherlich, E. A., 416
Modilevski, I., 607
Moldenhawer, K., 345
Moog, H., 643
Moussouros, B. G., 512
Mudaliar, C. R., 340
Müller, K. O., 472, 575
Müntzing, A., 451

Nakajima, G., 509
Narasinga Rao, M. B. V., 361
Narayana, G. V., 401
Narayana Rao, T., 334
Narayanan, T. R., 334
Navashin, M. S., 445
Neal, N. P., 547
Nemec, B., 668
Newman, I. V., 391, 392
Nicolaisen, W., 524
Nicolas, G., 495
Nisikado, Y., 673
Nolla, J. A. B., 603, 609
Nye, G. W., 351

Oehler, E., 507
Oksijuk, P., 590
Ono, Y., 658
Oppenheimer, H. R., 430
Ortega Nieto, J. M., 635
Overton, J. B., p. 206

Panduranga Rao, V., 337
Panse, V. G., 358
Papadopoulos, D. C., 512
Parnell, F. R., 347
Parthasarathy, N., 341, 342, 344
Patel, J. S., 401
Pavloff, K., 428
Peacock, H. A., p. 205
Pearse, H. S., 579
Persidsky, D., 607
Peturson, B., 323
Piacco, R., 566
Pierce, W. H., 667
Piescu, A., 600
Pirovano, A., 646
Pissarev, V. E., 493
Pittier, H., 615
Pollock, N. A. R., 322
Pope, M. N., 553
Portères, R., 611
Pound, F. J., 382–386
Priego, J. M., 634

Raabe, A., 571
Ramaer, H., 618
Ramakrishnan, S. R., 332
Ramanatha Iyer, V., 360
Ramanujam, S., 341, 342, 344
Ramiah, K., 338, 340, 342, 344, 389
Rangasami, K., 336
Rangaswami Ayyangar, G. N., 332, 334, 335, 337, 406–408
Rave, L., 597
Rayappa Pillai, M., 389
Rayss, T., 551
Reinking, O. A., p. 208
Rhoades, M. M., 531
Rice, M. A., 484
Roemer, T., 520
Roemer, W., 572
Rogers, W. S., 320
Romberg, L. D., 629
Rosborough, J. F., 628
Rosenfeld, A. H., 362
Rounce, N. V., 354
Rudorf, W., 433, 663

Sakai, K., 564
Salmon, E. S., 388
Sampaio, A. J. de, 613
Sampietro, G., 560, 561
Sanders, H. G., p. 207
Sando, C. E., 330
Sansome, F. W., 434
Săulescu, N., 419
Savage, D. A., 467
Savulescu, T., 551
Sawhney, K., 349
Sayed, I. A., 403
Schaffner, J. H., 461, 636
Schiemann, E., 456
Schlösser, L. -A., 444
Schmidt, M., 474, 608
Schribaux, 420
Selénin, I. L., 647
Sengbusch, R. v., 569–571
Seshadri Sarma, P., 334
Sethi, B. L., 313
Sethi, D. R., 377
Sethi, R. L., 313
Shcherbina, M. L., 626
Shen, L. Y., 510
Sherman, M. S., 330
Shuhart, D. V., 630
Sibilia, C., 514
Silvela, F., 518
Singh, T. C. N., 411
Sinnott, E. W., 437
Skovsted, A., 355
Slate, G. L., 632
Sleeth, B., 479
Smith, C. L., 629
Smith, D. C., 525
Smith, G. M., 532, p. 206
Smith, S. N., 548
Snell, K., p. 209
Snell, M. E., 657
Snowden, J. D., 379
Sosa-Bourdouil, C., 533, 669
Spengler, O., 593

Sprague, H. B., 545
Stadler, L. J., 535
Stakman, E. C., 476, 488
Stanton, T. R., 522
Stapp, C., 576
Stehlik, V., 421
Stelzner, G., 663
Stevenson, G. C., 375
Stitt, R. S., 619
Straib, W., 477, 478, 558
Strickland, A. G., 397
Stuart, W., 577
Stummer, A., 644, 645
Sutton, E., 410
Swingle, D. B., p. 206

Tavčar, A., 513, 542, 559
Thone, F., 441
Tims, E. C., 585
Tischler, G., 460
Titta, G., 500
Todaro, F., 482
Torrie, J. H., 328
Tschermak-Seysenegg, A., 443
Tubeuf, C. F. von, 652
Tumanjan, M. G., 491
Turner, D. M., 404
Turrill, W. B., 318, 450
Tuschnjakowa, M., 568

Ullstrup, A. J., 473

Vasconcellos, J. de Carvalho e, 465
Vasey, A. J., 321
Venkatraman, T. S., 370
Vik, K., 436
Voelcker, O. J., 387
Vyvyan, M. C., 320

Wade, B. L., 432
Wagner, S., 521
Wahlen, F. T., 485, 521
Wakakuwa, S., 503
Wakar, B. A., 506
Walker, J. C., 661, 662
Wallace, H. A., 530
Wålstedt, I., 489
Warmke, H. E., 469
Watanabe, T., 497
Watkins, A. E., p. 204
Wellhausen, E. J., 550
Wilks, S. S., 413
Williams, C. H. B., 378
Wilson Mayne, W., 381
Winkler, H., 447
Wishart, J., p. 207
Wollenweber, H. W., p. 208
Wright, S., 449
Wrinch, D. M., 452
Wulff, A., 562, 563

Yamauti, K., 673
Yarnell, S. H., 578, 631
Yeager, A. F., 621

Zaumeyer, W. J., 432, 672
Zavoronkov, P. A., 624
Zebrak, A. P., 439
Zirkle, C., 448
Zuhr, E., 487, p. 208

IMPERIAL AGRICULTURAL BUREAUX

EXECUTIVE COUNCIL.
2, Queen Anne's Gate Buildings, London, S.W.1.

IMPERIAL BUREAU OF SOIL SCIENCE.
Rothamsted Experimental Station, Harpenden, Herts.

IMPERIAL BUREAU OF ANIMAL NUTRITION.
The Reid Library, Rowett Institute, Bucksburn, Aberdeen.

IMPERIAL BUREAU OF ANIMAL HEALTH.
Veterinary Laboratory, New Haw, Weybridge, Surrey.

IMPERIAL BUREAU OF ANIMAL GENETICS.
King's Buildings, University of Edinburgh, Scotland.

IMPERIAL BUREAU OF PLANT GENETICS (FOR CROPS OTHER THAN HERBAGE).
School of Agriculture, Cambridge.

IMPERIAL BUREAU OF PLANT GENETICS (HERBAGE).
Agricultural Buildings, Alexandra Road, Aberystwyth.

IMPERIAL BUREAU OF FRUIT PRODUCTION.
East Malling Research Station, East Malling, Kent.

IMPERIAL BUREAU OF AGRICULTURAL PARASITOLOGY.
Winches Farm, Hatfield Row, St. Albans, Herts.

The Imperial Bureau of Plant Genetics

Director : PROF. SIR R. H. BIFFEN, M.A., F.R.S.
Deputy Director : P. S. HUDSON, Ph.D.

Assistants :
MRS. R. M. INGHAM, M.Sc.
MISS M. L. C. WILSON, B.A.
J. L. FYFE, B.Sc.
Secretary : MISS K. M. STEARN

IMPORTANT NOTE.—Every effort is made by the staff of the Imperial Bureau of Plant Genetics to make Plant Breeding Abstracts as complete as possible and to include all papers referring to plant breeding or the genetics of crop plants with the least possible delay after publication. In order to ensure this authors are invited to send copies of their papers immediately on publication to the Deputy Director.

Plant Breeding Abstracts are issued quarterly at an inclusive price of 15/- per annum, single copies 5/-. Subscriptions or exchanges should be sent to the Deputy Director, Imperial Bureau of Plant Genetics, School of Agriculture, Cambridge, England.

The following publications of the Bureau are available at the prices indicated :

	s.	d.
Wheat Breeding Bibliography, Part I ...	1	6
" " " Part II ...	2	6
Oat Breeding Bibliography	1	6
Rye Breeding Bibliography	1	6
Barley Breeding Bibliography	1	6
Bibliography on Breeding Sorghums and Millets	1	0
Rice Breeding Bibliography	1	6
Breeding Varieties Resistant to Disease ...	2	0
Lodging in Cereals		6
Bibliography on Interspecific and Intergeneric Hybridization in Relation to Plant-Breeding	2	0
Account of the Research in Progress in the British Empire	3	6
Subject Index to Vols. I to III of "Plant Breeding Abstracts"	2	6
Subject Index to Vols. I to V of "Plant Breeding Abstracts"	5	0
Vernalization and Phasic Development of Plants	10	0
Plant breeding in the Soviet Union. Achievements, organization and future programme of the Institute of Plant Industry	3	6
Bibliography of Baking Quality Tests ...	2	6
Summary of Reports received from countries exclusive of the British Empire, 1928-31. Supplement I.	2	6
Breeding Resistant Varieties (Supplement)	2	0

Printed by R. I. Severs, 5a, Market Hill, Cambridge